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ABSTRACT

Results of a survey of secondary schools indicate that the use of computers, especially for instructional purposes, has grown rapidly. However, the diversity of use is still limited. The most prevalent applications are problem solving and Electronic Data Processing (EDP) skills training. The major emphasis of computer application is on teaching students to use a computer as a tool in learning. Most instructional applications occur in the mathematics courses. Local sources provide the majority of funds for instructional computer use. Plans for future use generally call for expansion of present applications. The survey was conducted by mail and by interview. Appendices include survey instruments, a list of schools called and visited, and sources of data for basic questions. (Author/MP)

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Survey of Computing Activities in Secondary Schools

[redacted]

Charles A. Darby, Jr.
Arthur L. Korotkin
Tania Romanoska

Final Report
OCTOBER 1970

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A SURVEY OF COMPUTING ACTIVITIES IN SECONDARY SCHOOLS

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FINAL REPORT

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ABSTRACT

A mail survey of 23,333 public secondary schools in the continental United States was conducted to gather information regarding primarily instructional use of computers. In addition, interviews were conducted at 50 selected schools throughout the country.

The study concluded that the use of computers, especially in the instruction in secondary schools, has grown rapidly. However, the diversity of use is still limited. The most prevalent applications are problem solving and CAI skills training. The major exception of computer application is in teaching students to use a computer as a tool in learning more about the subject area in which the computer is being applied. Most instructional applications occur in the mathematics courses. Local sources provide the majority of funds for instructional computer use. Plans for future use generally call for expansion of present applications.

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INTRODUCTION

Education, more than any other single institution, has been called upon to meet the demands of our pluralistic society. The diversity of these demands has kept education from establishing a set of specific and clearly defined and universally accepted goals. From this maze of diversity, only two goals appear to enjoy general acceptance. First, our society believes that all individuals should have access to education commensurate with their desires and abilities. This goal has not been reached and still guides the educational effort of our society.

Secondly, we are committed to providing instruction which is sensitive to the individual differences of students in ability and interest. The necessity of utilizing different instructional techniques with students who deviate from normal ("the gifted" and "the slow learner") has been recognized for some time. The advent of individualized instruction goes one step further by suggesting that even "normal" children differ sufficiently from one another to warrant instruction which is designed to meet individual needs. Individualization of instruction has not progressed very far in practice, and it too remains a goal of American education.

Meeting one of these goals without endangering the other presents a formidable challenge to our educational system. Educating the masses would be easier if all students were taught in a uniform manner and differed only in how much education they received. Likewise, individualizing instruction would be easier if the range of individuals or the numbers of individuals taught could be reduced. But we are committed to an educational policy which precludes any either/or choice. We cannot truly educate all students unless we educate each student.

The problem of accomplishing both goals is compounded by the explosion of population and knowledge. There are more people to whom more must be taught. Educators, striving to meet this demand, have embraced innovational teaching techniques, particularly technology.

Some have mistakenly become dependent upon technology as the solution to all educational problems. Most have applied technology as one of several powerful tools useful in the solution of these problems. The last decade has seen the rapid spread of computer use for a great variety of applications in business, industry, the military, and science. The educational system, traditionally conservative, started later in applying computer technology. However, under tremendous pressure to exploit this country's tremendous technological resources, educators have begun to utilize computers at a rapidly increasing rate. Earlier surveys have documented the use of computers in education (Goodlad, O'Toole & Tyler, 1963 and Bunge & Hillstad, 1970). At first, computer applications were limited to the administrative functions performed in schools. However, computers were soon introduced into the instructional process. It is in this latter area where the greatest growth is taking place.

The acceleration of movement in this direction is evidenced by the proliferation of books, articles and conferences concerning the use of computers in education. Such a trend is not limited to the United States but is obviously international in scope. Just recently the International Federation for Information Processing held a "World Conference on Computer Education, 1970" in Amsterdam with the use of computers in education a major theme.

Both the National Science Foundation and the United States Office of Education, under existing federal legislation and appropriations, have missions in support of the nation's schools. As a basis for establishing policy, projecting needs, and accomplishing realistic planning, these agencies need factual information on present activities and state-of-the-art in the use of computers within the current educational system.

Many of the more widely known current educational applications of computers are aimed at elementary education, and at higher and continuing education. Little has been known concerning the extent and nature of educational computer use in the secondary schools. In order to provide the needed information, the American Institutes for Research conducted a survey sponsored by the National Science Foundation and concerned with the

educational and administrative uses of computers in public secondary schools. The principal focus of the study was on instructional, rather than administrative, computer use.

PURPOSE

Most simply stated, the purpose of this survey is to describe the application of computers in secondary schools in the continental United States. The description is brief and general in those cases where the computer is used for administrative purposes. On the other hand, the description of instructional applications is detailed and comprehensive. The study reports several categories of information about these applications.

For administrative applications:

- Extent of use in total population
- Degree of use among computer users

For instructional applications:

- Extent of use in total population
- Degree of use among computer users
- Nature and purpose of use
- Type of source and level of support
- School characteristics and use
- Previous use
- Plans for future use

To further define these general categories of information about computer applications, a number of basic questions were asked. These questions are listed below arranged by the categories shown above except that the first two categories deal in part with both administrative and instructional applications.

Extent of Administrative and Instructional Applications

1. How many secondary schools are using computers for administrative purposes?

2. How many schools are using computers for instructional purposes?

Degree of Administrative and Instructional Use Among Computer Users

3. How many computers are being used for administrative purposes?

4. What is the nature of the arrangement for the administrative

use of computers?

5. How many computers are being used for instructional purposes?
6. What are the arrangements for the instructional use of computers?
7. How many different instructional applications are there per school?
8. What is the degree of student and teacher involvement per school in instructional applications?
9. What is the amount and frequency of use of computers for instruction?

Nature and Purpose of Instructional Use

10. How many schools are involved in each of the various types of instructional applications?
11. What are the patterns of instructional applications in the schools?
12. What do the students and teachers actually do when they are participating in the applications?
13. What are the overall purposes of the applications?
14. To what degree are various subject areas involved?
15. To what degree are computers integrated into the curriculum?
16. At which grade level are various applications introduced?
17. What is the student's and teacher's involvement in each application?
18. What is the degree of student/computer and teacher/computer interaction?
19. What level of proficiency are students expected to achieve?
20. What do computers contribute to the learning process in the school setting?
21. Who prepares software for the applications?
22. Which programming languages are used?
23. What is the nature of computer running time?

Level and Source of Support of Instructional Use

24. What are the costs of instructional computer applications?
25. What is the degree of support from various levels of government and other sources?
26. What are the sources and level of support for specific applications?

27. What cooperative arrangements exist for supporting and developing computer applications?

28. What commitment do schools have to instructional applications in terms of the number of trained staff, organizational acceptance, and integration into the curriculum?

29. Which organizations provided training for teachers and other personnel?

School Characteristics and Use

30. What characteristics about a school are related to computer use?

Previous Use

31. How do schools get started in the instructional use of computers?

32. What type of applications now discontinued did schools have previously?

33. What reasons are given for terminating previous computer use?

Plans for Future Use

34. How permanent are present applications?

35. What type of applications do schools intend to initiate?

36. When do they plan to implement these applications and from which organizations do they anticipate seeking support?

37. What problems are associated with the use of computers in schools?

38. What do schools need for future expansion of instructional applications and how can outside sources best help?

SUMMARY OF RESULTS

The information resulting from the survey of computer use in public secondary schools is summarized below. Detailed information is reported later in the RESULTS AND DISCUSSION section. The page numbers listed beside each major heading indicate where the reader can find more detailed information in the RESULTS AND DISCUSSION section. Interpretations drawn from the survey data are reported later in the CONCLUSIONS section.

Extent of Administrative and Instructional Applications (Pp. 26-32)

- Of the schools responding to the survey, 3,776 (30.5%) were using computers for administrative purposes.
- There were 1,599 (12.9%) schools surveyed which reported instructional computer use.
- Overall, 4,259 schools, 34.4% of those responding, reported some type of computer use.
- The geographic dispersion of these user schools showed clustering around major metropolitan areas.

Degree of Administrative and Instructional Use Among Computer Users (Pp. 32-40)

- 39.8% of computers used by administrative users were leased and 36.1% were used on purchased time basis.
- Of the computers used by instructional users, 41.3% were leased and 28% used on purchased time basis.
- Almost 30% of user schools reported using more than one computer for their applications.
- Just over half of the computer users reported more than one application and about one-third reported more than two applications in the schools.

- In a "typical application," there was a median of 30 students, each of whom participated on the average of about 10 hours per month.
- On the average, two teachers each spent about 20 hours per month in a "typical application."

Nature and Purpose of Instructional Use (Pp. 50-62)

- The instructional applications listed in order of frequency of mention in the mail survey were: CAP skills training, problem solving, guidance/counseling, gaming/simulation, computer assisted instruction, management of instruction, other classroom instructional applications, mediated instruction, and other instructional applications. Follow-up interviews confirmed the domination of applications by CAP skills and problem solving, but indicated that computer assisted instruction and guidance and counseling are not as prevalent as reported in the mail survey.
- A variety of patterns of combinations of applications emerged, clustered around two cores of applications. These were a guidance-administration cluster and a problem-solving-CAP skills cluster or core.
- The most frequently mentioned student activity was writing and running programs with teachers assisting.
- Although the overall purposes of the applications varied widely, there was a general emphasis on using the computer as a tool to accomplish subject matter goals rather than on learning about the computer as an end in itself.
- Applications of computers to mathematics instruction dominated. Almost three-quarters of all computer applications were involved with mathematics instruction.
- There was very little formal integration of computers into the curriculum except in mathematics where there was a little more integration.

- The modal grade in which instructional computer applications were introduced was grade 10 with some variation across applications within grades 9-11.
- Hard data were difficult to find regarding the effect of computers on the learning process in the school setting. However, teachers testified to a significant effect of computers. Most frequently mentioned was the motivational influence of computers on students participating in the applications.
- Teachers, computer specialists and students, in that order, most frequently prepared software for instructional applications reported by schools.
- Overall the most frequently mentioned programming language used for instructional applications was FORTRAN, second was BASIC; third, a combination of "other" languages, the largest proportion of which was machine language; and fourth, assembly languages.

Level and Source of Support of Instructional Use (Pp. 82-86)

- The median cost per school for instructional computing was $14,000 but there were considerable variations in the costs. The median percentage of the annual operating budgets of the instructional users as represented by their annual instructional computer budget, was .4%.
- More schools (32.3%) indicated that each of their applications cost between $1,000 and $5,000, on the average, than any other range of cost.
- Schools reported that 80% of their computer budget comes from local sources. It is suspected, however, that those providing these data were not fully aware of the initial source of their funds.
- The reported domination by local sources of support generally held up across individual applications. Non-local sources mentioned most frequently were: National Science Foundation,

Office of Education, state governments and college and universities.

- A wide variety of different types of cooperative arrangements exist for supporting and developing computer applications between secondary schools and other schools, school systems, colleges and universities, commercial networks and formal networks.
- A serious commitment to the use of computers outside the mathematics departments was not evident.
- Colleges and universities were mentioned most frequently and computer manufacturers second most frequently as the conductors and sponsors of teacher training for computer use. The National Science Foundation was listed third most frequently as the sponsor of computer training for teachers.

School Characteristics and Use (Pp. 96-101)

- Schools which reported instructional applications tended to be larger in enrollment and teaching staff, to send more graduates to college and junior college, and to be more predominately comprehensive senior high schools when compared to those schools not reporting instructional use.

Previous Use (Pp.102-107)

- Instructional computer use frequently developed independently of administrative use.
- Most computer applications which schools reported terminating were administrative (56.0%).
- A broad range of reasons were given for terminating certain computer applications. The most frequently mentioned reasons were concerned with lack of funding and space.

Plans for Future Use (Pp. 107-114)

- Although funding for computer applications is sometimes a year-to-year proposition, teachers generally appeared confident that

the applications will continue indefinitely.

- Users indicated a greater intention to initiate new applications than did nonusers. There was a tendency for users to initiate applications similar to those in which they were already involved.
- Local and state were mentioned most frequently as anticipated sources where support would be sought for new applications in the future.
- There was a general satisfaction among computer users regarding instructional applications. However, problems did exist. Most frequently mentioned problems dealt with insufficient access to computers.
- Needs for future expansion of computer use among instructional users typically involved one or more of the following: funding, training of staff and information.

PROCEDURE

The survey was conducted in the following ten phases:

I. Development of operational definitions
II. Questionnaire development
III. Questionnaire dissemination
IV. Processing of questionnaire returns
V. Postal card follow-up
VI. Interview sample identification
VII. Development of interview
VIII. Conduct of interviews
IX. Data analysis
X. Nonrespondent follow-up

I. Development of operational definitions

The first step was to establish operational definitions for the several terms critical to the study. It is particularly important in mail surveys to provide clear, concise definitions. If meaningful data are to be gathered, there must be a reasonable consistency to the interpretation respondents give to the terms in their questionnaires. RIR drafted a set of definitions to be used and submitted these to NSF for consideration. After some discussion, NSF and RIR agreed upon the definitions which follow. These definitions provide a frame of reference for interpreting the results of this study.

a. Computers

Computers which are of interest in the present survey are those general purpose computers which operate under the control of a stored program. The term computer refers to the integral system which includes the central processing unit, auxiliary storage, communication links, and all peripheral equipment. To be considered a computer a machine must be capable of producing more than routine mathematical computation as the end product of its operation. The programmable desk top calculator is included only when it is operated with a stored program.

Electronic accounting machines are specifically excluded.

b. Application

Two general categories of computer use, instructional and administrative, were described. Applications (1) through (9) listed below are instructional. Application (10) is administrative.

(1) Computer-assisted-instruction, including drill and practice, tutorial and dialogue modes using programmed instructional techniques.

(2) Computer used as a computational aid to problem solving in classes and laboratories for science, mathematics, accounting, economics, etc.

(3) Teaching electronic data processing skills to students, including the preparation of input, machine operation, programming and systems analysis skills. The instruction must include the running of a program on a computer.

(4) Gaming and simulation of real life situations using a computer.

(5) Computer-mediated instruction involving TV, film, etc., including the use of a computer to control the presentation of media in the classroom or other learning situation, or to analyze multi-media classroom responses.

(6) Any other classroom or laboratory learning applications.

(7) Management of instruction, including individual instructional diagnosis through the analysis on a computer of student learning needs and progress and the prescription of individual instruction.

(8) Guidance and counseling, including academic guidance, occupational counseling, and personal adjustment counseling. A computer might be used to store and

analyze, or retrieve information concerning such assessment measures as ability and achievement tests, personality profiles, occupational interest data, etc.. (When test scoring and analysis are performed by a commercial test publisher, they should not be reported here as a computer application in the school.)

(9) Any other application of a computer for instructional management, guidance and counseling.

(10) Administrative applications including:

- Student accounting: to arrange student schedules; to keep student records, such as educational history, attendance, and grades; or to prepare report cards, etc.
- Resource management: to schedule transportation, classrooms, etc.; to maintain personnel and financial records; or to allocate materials.
- Planning: to plan for future resource allocation by projection of enrollment, census-taking, educational system simulation, etc.
- Research and evaluation: to study and evaluate teaching methods, the learning process, curriculum, instructional materials, etc.

c. Access to the Computer

To be included in this survey, it was not necessary that a computer application involve a computer which was located in the school. Access to a computer might be classified as any one of the following:

- Immediate access - Computer physically present in school or school system, either owned or leased.
- Remote access - Terminal in school, connecting with computer at any location (e.g., a network of schools or time-shared system).

- Periodic access - Computer located close enough to school that visits could be made to use the computer.

d. Funding

Schools were asked to report in this survey only those computer applications in which the school or school system was responsible for some portion of the cost of the application. That is, some part of the cost of the application must be covered by the operating budget of the school or school system, regardless of the source of the support and nature of the investment. The investment, for instance, might take the form of staff time devoted to the application, just as long as the cost of that staff time was part of the operating budget.

2. Questionnaire development

After the definitions had been established, the instrument for data collection was developed. This development entailed the construction and testing of a pilot questionnaire.

a. Construction of the pilot questionnaire

The guidelines for the questionnaire required that it be (a) modular, thus requiring a minimum of effort on the part of those not using computers; (b) primarily designed to gather information about instructional computer uses; (c) as brief, clear, and explicit as possible while still obtaining the needed information; and (d) able to gather responses in a mode amenable to accurate compilation, analysis and interpretation.

From the above guidelines, the questionnaire was constructed to collect information including:

- Demographic data about the school (grades, enrollment, staff size, type, percentage of graduates going on to post-secondary education, etc.).
- Previous and anticipated use of computers.
- Present use of computers (which application(s) presently involved in).
- School budget and the portion of the budget allocated to

to instructional application of computers.

- Computer systems in use.
- Detailed information regarding each instructional application, such as: purpose, subject areas covered, number of student and teacher participants, hours of student and teacher use per month, computer time used per month, software programs for the system, programming language(s) used, description of the actual tasks performed by students, sources of support and amount contributed by each source.

b. Pilot testing the questionnaire

Four secondary schools in the Washington, D. C. area which agreed to participate in a pilot test were sent the draft questionnaire, with instructions for completing it. Project staff visited these schools and interviewed those individuals who had filled out the questionnaire. Purposes of the interview were to uncover any ambiguities in the questionnaire, to identify any difficulty in providing the requested information, to determine the amount of time and effort required to gather the data, and to evaluate the degree of reliability and validity which might be expected from the data.

Following the interviews, the questionnaire was revised a final time and submitted to NSF for final approval. A copy of the final instrument is included in Appendix I-B.

3. Questionnaire dissemination

NSF specified at the outset that the survey would involve the total population of public secondary schools (schools with one or more of grades 9-12) in the continental U.S. rather than a sample of these schools. The total population survey was preferred because NSF wished to gather as much information as possible, particularly about the instructional application of computers. In this context, information was needed about the atypical applications as well as the typical applications. Suspecting that only a small percentage of the schools were using computers instructionally, a very large sample of schools

would have had to be drawn in order to gather the information desired about the wide range of instructional computer applications.

If the primary purpose had been only to make statistical descriptions of the extent and use of computers in the population, NSF would have specified that a small sample of schools be drawn from the population. This approach would have permitted intensive follow-up to assure an extremely high rate of return. However, the enlightening information gathered about the range of computer applications, including many exemplary programs of computer use, may have been lost. The total population survey approach used in this project is more difficult to follow-up due to the large number of schools, but is more likely to uncover more useful information.

Arrangements were made with the National Association of Secondary School Principals (NASSP) for the use of a magnetic tape file of the names and addresses of all secondary schools in the United States. Details were worked out for the printing and automated mailing of the questionnaires. Procedures for the efficient receipt, processing, and coding of the questionnaires were developed.

When final approval of the questionnaire was received, 23,500 copies were printed and mailed, addressed to the principal of the school. The first mailing occurred near the end of January, 1970. A follow-up mailing to nonrespondents was made one month later. The final version of the questionnaire contained a cover letter, questionnaire booklet and answer sheet. The questionnaire with different cover letters used for the two mailings appears in Appendices I-A and I-B.

4. Processing of questionnaire returns

As each questionnaire was received, it was edited and coded. Coders made sure that the school had at least one or more of grades 9-12 and was located in the continental United States (requirement for inclusion in the survey). Although the NASSP file was as accurate and up-to-date as possible, there were schools in the file which did not meet the geographic and grade level requirements of the study.

Those which could be identified were eliminated from the survey. The number of these type of responses and their effect on the size of the overall sample will be described later in the RESULTS AND DISCUSSION section.

The questionnaires were then stamped with an identifying sequence number and responses checked for clarity and readability. Coders resolved any ambiguities in the questionnaires which might result in distortion in later data analysis. For example, some respondents accidently reversed their answers to the teacher and enrollment questions, thus reporting more teachers than students.

Coders then proceeded with the coding of several items on the questionnaire. The data collection device had been constructed to require as little coding as possible. The items which were coded were:

A-13 Reasons given for stopping an earlier computer application in the school.

C-2 (Column 3) The names of the computers and terminals listed as being used by the schools.

D-1 The "Purpose" and "Activity" statements provided for each application.

D-3 Subject area, such as mathematics, English, biology.

D-14 and D-15 The "Software Preparer" and "Programming Language(s)"

D-16 "Source" of support and "Amount" of support for each application.

The questionnaires were sent in batches for keypunching and verifying. Samples of cards punched and verified for the first few hundred questionnaires were checked to assure that the punching was being performed as intended. Almost all of the data on the questionnaire were keypunched, exceptions being:

A-13 Reason for stopping.

D-1 Purpose and Activities.

B-16 Source and Amount.

These items were copied on 3 x 5 cards. They were manually edited and analyzed after all responses had been received so that appropriate coding categories could be developed.

When the questionnaires were returned from keypunching, they were separated into four mutually exclusive groups: (a) nonusers (those not using computers), (b) administrative only users (those with administrative use only), (c) instructional only users (those with instructional use only), (d) combined users (those with both administrative and instructional use). Each school reporting one or more computer applications was represented on a large 6' x 6' zip code map of the United States by a pin stuck in the area on the map corresponding to the geographic location of the school. The pins were color-coded to represent each of the three mutually exclusive categories of computer use (administrative only users, instructional only users and combined users). This technique provided a graphic display of the geographic dispersion of computer users.

5. Postal card follow-up

Based on previous knowledge of administrative computer use, it was suspected that the true extent of administrative applications was not being reflected in the questionnaire data. Therefore in April it was decided to send nonrespondents to the first and second mailing of the questionnaire an additional probe consisting of a brief postal card questionnaire. This third mailing included only four questions designed primarily to determine the existence and level of administrative and instructional use among the remaining nonrespondents. The postal card was prepared and approved by NSF and mailed during the third week in May. A sample of the postal card is included in Appendix I-E.

As these cards were returned, they were stamped with a sequence number, edited, keypunched and verified.

6. Interview sample identification

As indicated earlier, a map of the United States which represented

the location of schools reporting computer uses had been prepared. Pins were placed in the area serviced by a Sectional Center of the United States Post Office. This area is defined by the first three digits of the zip code. A pin representing a particular school was placed in the area whose first three zip code digits corresponded to those in the school's address.

The plan originally called for the NSF Office of Computing Activities to review the map in order to select clusters of computing activities. As an aid to selecting these clusters, ASR identified 19 clusters of computer activities as candidates for follow-up interviewing. (Selected candidate clusters appear in the RESULTS AND DISCUSSION section and Appendices 2-A and 2B.) After a preliminary report had been presented to NSF in April, the plan was changed in order to select schools from nonclustered areas as well as clustered areas. This new plan provided broader geographic coverage and avoided any systematic bias in data gathered only from schools closely nested together near large metropolitan areas. The design was further modified to expand interview coverage by adding telephone interviews. This technique permitted wide geographic coverage while keeping down the cost of interviewing.

The design for the on-site and telephone interviews was as follows:

	Cluster	Noncluster	Total
Visited	30	20	50
Telephoned	15	25	40
TOTAL	45	45	90

NSF selected the clusters of schools with instructional applications which should be visited and those which should be telephoned. Within each cluster, individual schools were selected by ASR so as to adequately represent each cluster. ASR also selected the noncluster schools with the intention of providing adequate geographic coverage. The actual schools visited and their locations appear in Appendix 2.

3. Development of Interview

The purpose of the interview was to validate the data provided

on the questionnaire and to gather supplementary data. Thirty-two questions were included in the interview. The interview questions appear in Appendix I-B. At the end of each interview, the questionnaire was to be reviewed with the interviewee to determine why items on the questionnaire, if any, were left blank and to ascertain what interpretation had been given to each question. This information allows for an evaluation of the degree to which respondents interpreted the questionnaire as it was designed to be interpreted.

B. Conduct of Interviews

After approval of the interview plan, the schools to be visited were contacted and an interview schedule was set up. During April and May, the interviews were conducted. Two-man teams travelled to the locations where the interviews were to be conducted in the schools. The Project Director and one other senior staff member performed the first site visit to five schools in Chicago. Upon their return, they briefed other members of the staff who would be conducting subsequent interviews.

The individuals to be interviewed by telephone were mailed a card on which they were asked to indicate three time periods during which they could be interviewed. When these cards were returned, telephone interviews were scheduled. Each interview was conducted by one interviewer. All of the interviews were completed during May and June.

For both personal and telephone interviews at each school, the interviewer talked with the individual(s) most involved with the instructional computer applications to assure that the best information available would be acquired. All interviews were tape recorded. This technique provided a verbatim record of the interview as well as freeing the interviewer to fully interact with each interviewee.

C. Data analysis

The data analysis phase of this project actually began with the identification of the candidate cluster and nonCluster areas described

earlier. In addition, two other large data analyses were performed to provide answers to the 5 basic questions posed in the PURPOSE section. The data related to each question appear in tabular form in Appendix 3.

There are only two major items of information which relate to the total population of schools. These are concerned with the extent of computer use as measured by the number of schools reporting computer uses and the basic characteristics of the schools (enrollment, type, etc.). Still other information was gathered from user schools only (budget, computers, etc.). The rest of the information representing approximately 90% of the mail survey data was gathered only from those schools using the computer for instructional purposes. It is this small subpopulation of schools to which the other basic questions address themselves.

a. Questionnaire/Postal Card

The items on the questionnaire and postal card yielded a number of both discrete and continuous variables. Each discrete variable was analyzed to produce frequency and percentages of responses in each category of the item. For example, the number and percent answering yes or no to whether or not they use computers (Questionnaire item B-17) was determined. Each continuous variable was analyzed to produce a mean, standard deviation, range and frequency distribution. For example, the mean, etc. of the enrollment variable were computed. These analyses were performed for almost all of the items using a set of computer programs. A few remaining items were analyzed manually.

b. Interview

As noted earlier, the purpose of the interviews was to gather verifying and supplemental information. The questions asked in the interview appear in Appendix E-3. Completion of both site visit and telephone interviews yielded approximately 70 hours of taped interviews. To capture the richness of the interviews, project staff listened to the tapes and extracted the essence of the responses using the interviewee's words and frame of reference. These extractions were then typed onto continuous form 3 x 5 cards, one extraction per card. These

cards were then grouped so that all responses to a particular interview question were together. Project staff then summarized the responses to each question. The summaries were written to reflect the pattern of responses emerging from the analysis without masking the contributions of unique and especially thought provoking answers. Stated another way the analysis and summarization of responses avoided the establishment of response categories and the reporting of the number of responses which were placed in each category.

10. Nonrespondent Follow-up

As a final step a follow-up of nonrespondents was performed. This follow-up was performed in order to estimate the degree of bias among nonrespondents, if any, in terms of extent of computer use. A random sample of 100 nonrespondents was selected. These schools were telephoned and asked whether they were using the computer for instructional purposes and/or administrative purposes during the school year 1969-70.

RESULTS AND DISCUSSION

In this section, the results of the analysis of data from all survey instruments (questionnaire, postal card, and interviews) will be reported and discussed. After describing the population surveyed and the sample which responded, each of the 38 basic questions listed earlier will be addressed in turn.

A. Population

As indicated earlier, the survey involved mailings to every public school with one or more of grades 9-12 located within the continental United States. This population totals 23,833 secondary schools.

B. Sample

The response rate to each of the three survey mailings is depicted in Table 1. The percentages shown indicate the proportion of the total population falling in each category.

Of the 23,833 schools in the population, 12,398 (53.0%) responded in some form. Total respondents consist of 3,770 (16.3%) of the total population who responded to the questionnaire and 8,628 (37.5%) who responded to the postal card.

The major purpose of this survey was to gather detailed, descriptive information about the instructional uses of computers in secondary schools. Although other data were gathered regarding the general extent of use of computers, the emphasis was not on making projections about computer activities in the total population in secondary schools. Instead, the emphasis was on accurately and comprehensively describing the computer use of respondents, particularly instructional users. In this regard not all of the 38 basic questions enumerated in the PURPOSE section apply to all secondary schools. In fact, most questions apply to only a portion of them, most frequently to the instructional users.

Table 1. Response Rates to Various Survey Mailings

Total eligible population = 23,033
Percentages based on total population

1st mailing questionnaire response	2nd mailing response	Postal card respondents	Nonrespondents
1920 (8.3%)	1850 (8.0%)	8,626 (37.5%)	10,637 (46.2%)

Questionnaire Response 3,770 (16.3%)

Total Respondents 12,396 (53.8%)

Table 2 shows the respondent group which provided information relevant to each of the 28 basic questions. For example the group of all postal card and questionnaire respondents, totalling 12,396 schools, provided information regarding extent of use (basic questions 1 and 2). Each group is designated by a letter for future reference.

Information related to each of the 28 basic questions is discussed below. Appendix 3 lists the number of each of the 28 basic questions and the identification of the corresponding items on the survey instruments from which relevant information was gathered. The basic questions are discussed generally in the order presented in the PURPOSE section arranged in the categories given in that section. The numbers of the basic questions being addressed in each section are listed in parentheses at the end of the section title. The respondent groups which provided information relevant to the basic question under discussion is designated by its reference letter shown in Table 2.

C. Results

1. Extent of computer use (Basic questions 1 & 2)

a. Overall computer use

The extent of computer use is indicated here by the number of schools reporting use on the questionnaire and postal card (Group A). Table 3 reports these data.

Of the total respondents, 4,259 or 34.4% indicated some use of a computer for either administrative or instructional purposes or both. From Table 3, it can be seen that the ratio of user to nonuser remained relatively constant from the questionnaire to postal card returns (32.4% and 35.2% users). The consistency of the response provides evidence that the overall extent of use measure of 34.4% is an accurate one and probably reflects the extent of computer use in the total population fairly well. Unfortunately, no evidence from earlier surveys is available for comparison purposes.

It was suspected that 34% was an overestimate since computer users were probably more motivated to return the questionnaires than nonusers. Earlier survey work reports that recipients of questionnaires

Table 2. Basic Questions and Corresponding Respondent Groups Providing Information

Basic Question	Respondent Group	
	Reference Letter	Composition
Extent of use (1 and 2)	A	All postal card and questionnaire respondents (12,396)
Previous use (31-33) Future use (34-36, 38) School characteristics (30)	B	All questionnaire respondents (3,770)
Degree of administrative use (3 and 4)	C	Just administrative users among questionnaire respondents (1,026)
Degree of instructional use (5-9) Nature and purpose (10-23) Level and source of support (24-29) Previous use (31-33)	D	Just instructional users among questionnaire respondents (666)
Nature and purpose (12-15, 17-21, 23) Level and source of support (24-29) Previous and future use (31-38)	E	Just instructional user schools responding to questionnaire where interview conducted (90)
Extent of use (1 and 2) Degree of use (9) Nature and purpose (15)	F	Just instructional users among postal card respondents (933)

Table 3. Responsents to Questionnaire and Postal Card Inquiries Categorised by Use, Nonuse, and Type of Use

Category of Use	Respondents					
	Questionnaire respondents		Postal Card respondents		Total respondents	
	N	% of Respondents	N	% of Respondents	N	% of respondents
1. Nonuser	2,549	67.6	5,588	64.8	8,137	65.6
2. User						
(a) Instructional only	195	5.2	288	3.3	483	3.9
(b) Administrative only	555	14.7	2,185	24.8	2,640	21.5
(c) Combined	471	12.5	645	7.5	1,116	9.0
(d) All instructional (a) and (c)	666	17.7	933	10.8	1,599	12.9
(e) All administrative (b) and (c)	1,026	27.2	2,730	31.9	3,756	30.5
3. Total respondents	3,770	100.0	8,626	100.0	12,396	100.0

who have something positive to report are more likely to return questionnaires than those who do not. To test this notion, a random sample of 100 nonrespondent schools were telephoned. In order to estimate the extent of use among the nonrespondents, staff in these 100 schools were asked whether the school used computers for instructional purposes and/or for administrative purposes during the 1969-70 school year. Table 4 contains the results of the nonrespondent follow-up.

It appears from the nonrespondent data that approximately 35% is a good estimate of the extent of use in the total population. The consistency of responses received regarding extent of use (32.4%, 35.2% and 35.0%) provides considerable credence to the estimate of about 35%. The other data in this table will be discussed later in the report.

It appears that the majority of secondary schools are not using a computer. At the same time, use of a computer in 4,259 of the schools responding to the survey is probably a large increase over what existed even five years ago.

b. Administrative use

Some interesting observations are evident among the types of users. The overall percentage of schools reporting use of a computer for administrative purposes only was 21.5%. The percentage reporting such use on the postal card was 24.4%, as compared to only 14.7% on the questionnaire. As already indicated, it was suspected that many schools which were using a computer for administrative purposes only had not responded to the questionnaire since they thought the survey emphasized instructional applications. The large discrepancy in the percentages of returns from these users supports this notion. In all probability, the actual percentage of use is somewhere between 15% and 25%. Results from the nonrespondents' survey show 19% users for administrative purposes only. Therefore, the extent of this type of use may very well be near the midpoint of the two estimates obtained.

The percentage of schools using a computer for administrative purposes (regardless of other use) was 30.5% and was relatively stable

Table 6. [illegible]ent of Use Among Nonrespondents Follow-up

Category of Use	Sample	
	N	Percent
1. Nonuser	65	65
2. User	35	35
(a) Instructional only	10	10
(b) Administrative only	19	19
(c) Combined	6	6
(d) All instruction (a) and (c)	16	16
(e) All administrative (b) and (c)	25	25
3. Total	100	100

from both the questionnaire and postal card (27.2% and 31.9% respectively). Nonrespondent follow-up shows 25% frequency of administrative use. Thus, it is reasonable to conclude that the percentage of schools using a computer for administrative purposes is around 25% to 30%.

c. Combined use

Combined uses (administrative and instructional) reported by 12.5% of the questionnaire respondents was reported by only 7.5% of the postal card respondents. The overall percentage was 9%. The extent of both administrative and instructional use among nonrespondents was 6%. It is felt that the lower figure, 7.5% from the postal card survey, is probably the best estimate of the occurrence of combined users in the population. It appears, at least, that the percentage of schools which use a computer for both administrative and instructional purposes is probably between 5% to 10%.

d. Instructional use

Data reported for instructional users show 12.9% of the respondents as instructional users, (17.7% from the questionnaire and 10.0% from the postal cards). The nonrespondents survey shows 16% of the schools reporting instructional use. It appears that about 10% to 15% of the schools use computers for instructional purposes. Most likely, the extent of instructional use in the population probably falls somewhere closer to the lower end of this range. It is suspected that the questionnaire data produced an overestimate of the number of instructional users since those with instructional use were more likely to respond.

The only previous data come from two earlier surveys. Goodlad, O'Toole and Tyler (1963) estimated a total of 300 secondary schools using computers or electronic accounting machines for instructional applications. In a study done in 1966, Bangs and Whitstad (1970) surveyed roughly 11,000 public secondary schools in the United States. They reported 181 instructional computer users or 1.7% usage. The estimate from the present study of 10% to 15% suggests a marked increase over the past four years.

e. Computer use by category of user

Table 5 reports additional information regarding the extent of computer use as it relates to selected user categories (Group A). Among computer users, administrative use predominates over instructional use. This observation is supported by the following information:

- The large proportion of all users are administrative users (88.0%) and administrative only users (62.4%)
- The corresponding small proportion of all users are instructional users (37.9%) and instructional only users (11.3%)
- The preponderance of instructional users are also using a computer for administrative purposes (69.8%)
- The small percentage of administrative users who also have instructional application (29.6%)

f. Geographic dispersion

Of considerable interest is the geographic spread of computer use. Figures 1 and 2 geographically display the spread of computer use. Each dot in Figure 1 represents a school which reported computer use and in Figure 2, each school reporting instructional use in the questionnaire (Groups C & D). Table 6 reports the number of using schools in each state by user category.

The spread of computer use is highly similar for instructional users and all users. The schools using computers tend to cluster around metropolitan areas. Therefore, the density of computer use corresponds closely to the density of population.

2. Degree of administrative and instructional use among computer users (Basic questions 3-9)

With the extent of computer usage in secondary schools established, the discussion will now be directed to the degree of computer involvement within the using schools (Groups C and D).

Table 5. Extent of Computer Use for Instructional and Administrative Purposes

Category of user	Respondents N	% of Total respondents	% of User respondents	% of Instructional respondents	% of Administrative respondents
1. Nonusers	8,127	65.6	--	--	--
2. Users	4,250	34.4	100.0	--	--
(a) Instructional only	485	3.9	11.5	30.2	--
(b) Administrative only	2,660	21.5	62.6	--	70.0
(c) Combined	1,105	9.0	26.2	69.8	29.6
(d) All instructional (a) and (c)	1,590	12.9	37.5	100.0	--
(e) All administrative (b) and (c)	3,776	30.5	88.6	--	100.0
3. Total respondents	12,396	100.0	--	--	--

RAND McNALLY

STATE OUTLINE MAP

UNITED STATES

RAND McNALLY

STATE OUTLINE MAP

UNITED STATES

Table 6. Computer Users by State

State*	Desktop. Only	Admin. Only	Combined	Total Desktop.	Total Admin.	Total Users
Massachusetts	8	27	24	32	51	59
Rhode Island	3	3	4	7	7	10
New Hampshire	2	0	3	5	3	5
Maine	1	3	0	1	3	4
Vermont	2	4	0	2	4	6
Connecticut	6	19	7	13	33	39
New Jersey	10	16	14	24	30	40
New York	29	20	33	62	53	82
Pennsylvania	16	32	27	43	59	77
Delaware	0	1	3	3	4	4
Maryland	2	6	7	9	13	15
Virginia	0	4	5	5	11	11
West Virginia	1	1	2	3	3	4
North Carolina	6	4	6	12	10	16
South Carolina	1	1	0	1	1	2
Georgia	1	1	1	2	2	3
Florida	4	10	11	15	21	25
Alabama	0	4	3	3	7	7
Tennessee	3	9	5	8	14	17
Mississippi	0	4	1	1	5	5
Kentucky	0	6	1	1	7	7
Ohio	5	39	13	18	52	57
Indiana	3	31	8	11	39	42
Michigan	4	45	20	24	65	69
Iowa	3	22	12	15	34	37
Wisconsin	4	39	23	27	62	66
Minnesota	16	13	24	40	37	53
South Dakota	0	0	0	0	0	0
North Dakota	0	1	1	1	2	2
Montana	1	2	5	6	7	8
Illinois	9	20	25	34	45	54

Table 6. Computer Users by State
(Cont'd.)

State*	Instruct. Only	Admin. Only	Combined	Total Instruc.	Total Admin.	Total Users
Missouri	1	7	1	2	8	9
Kansas	1	3	16	17	19	20
Nebraska	2	6	4	6	10	12
Louisiana	0	5	3	3	8	8
Arkansas	0	1	1	1	2	2
Oklahoma	2	3	27	29	30	32
Texas	3	23	9	12	32	35
Colorado	8	7	7	15	14	22
Wyoming	0	2	3	3	5	5
Idaho	1	0	1	2	1	2
Utah	1	8	6	7	14	15
Arizona	2	17	4	6	21	23
New Mexico	0	1	2	2	3	3
Nevada	1	4	1	2	5	6
California	17	34	58	75	92	109
Oregon	6	16	19	27	35	43
Washington	3	19	19	22	38	41
	195	555	471	666	1026	1221

*Arranged in zip code order to represent regional concentration of computer use.

a. Number of computers

Table 7 shows the number of computers reported by administrative and instructional users for each of the types of use. Also shown is the percentage of the total computers reported by user groups for which use was specified represented by each type of use.

Table 7, of course, includes only those computers reported by using schools. A number of the computer users did not specify which computer was being used. In fact, 434 schools did not report the name of the specific computer in their questionnaires. By definition of this survey, a school is a computer user only if it actually uses a computer. Therefore, it could be assumed that these 434 schools use at least one computer. In turn then, it could be concluded that the 1,221 users included in the survey use at least 1,287 computers (853 reported and 434 projected). Data discussed here, however, will pertain to just those schools reporting which computer was being used and in some instances only those computers for which category of use was reported.

Furthermore, in interpreting these results, two points must be kept in mind. First, some of the schools included in this analysis may be sharing a computer with each other. Therefore, the number of computers listed does not represent separate, unique computers in use. Rather, it represents the number of school-computer relationships which exist, with some schools involved in more than one such relationship. For ease of discussion these relationships will be referred to as computers being used. Second, some of the computers counted here are located in the schools, while others are located at remote sites where they are used through a telecommunications hook-up, or material is taken to the site to be run.

The last column of Table 7 shows a total of 853 computers. However, the type of use was specified for only 815 of these computers. Therefore, of the 815 for which use was specified 63.2% were being used for instructional purposes and 58.6% for administrative purposes. In the last column for (d) instructional use it is reported that 515

Table 7. Computers Being Used by Administrative and Instructional Users for Various Types of Use*

Type of use	Type of User: Instructional users N	Instructional users %	Administrative users N	Administrative users %	All users N	All users %
(a) Instructional only	337	55.5	160	25.1	337	41.3
(b) Administrative only	92	15.2	300	47.0	300	36.8
(c) Combined	178	29.3	178	27.9	178	21.8
(d) Instructional (a) and (c)	515	84.8	338	53.0	515	63.2
(e) Administrative (b) and (c)	270	44.5	478	74.9	478	58.6
Total for which use specified	607	--	638	--	815	--
Total for which use omitted	38	5.9	23	3.5	38	4.4
Total	645		661		853	

*Based on response of 787 users providing data regarding type of computer used (612 instructional and 583 administrative).

computers were being used for instructional purposes and 478 for (a) administrative purposes. Some of these computers,170 (28.9%),were being used for both purposes. Schools reported that 36.8% of the computers were being used for administrative purposes only and 41.3% for instructional purposes only. These data indicate slightly higher instructional use than administrative use. This information is in contrast to the dominance of administrative users in terms of the number of schools reporting computer applications. This turn around is attributable to the greater number of computers which are used for instructional purposes only (337) than those used for administrative purposes only (300). In this regard, it is interesting to note that of the computers used by administrative users, 25.1% are used for instructional only purposes. At the same time, only 15.2% of the computers used by instructional users are used for administrative purposes only.

Other data from questionnaires returned by schools with more than one computer indicate a dominance of instructional uses among those computers beyond the first computer.

This information is supported by the results of school interviews. Teachers frequently indicated that although their schools first used a computer for administrative purposes, a subsequent computer was secured for instructional applications.

Before leaving the discussion of the number of computers being used, another item of information is relevant. Table 8 represents the number and percentage of schools in each user category using a specified number of computers (Groups C & D).

Almost 30% of all schools reporting computer use indicated that they are using more than one computer. From Table 3 it is evident that computer use has not spread to a majority of schools; however, there is a significant percentage of user schools which are involved enough with computers to use more than one. Most observers would be surprised by this degree of use.

Although the degree of use does not generally vary much across user types, one important difference should be noted about schools

Table 8. Schools in Each User Category Using Specified Number of Computers

Number of Computers	Type of User											
	Administrative only		Instructional only		Combined		All Administrative		All Instructional		All	
	N	%	N	%	N	%	N	%	N	%	N	%
1	134	88.7	109	73.6	214	63.5	348	71.3	323	66.6	457	71.9
2	17	11.3	35	23.6	99	29.4	116	23.8	134	27.6	151	23.7
3	0	0.0	3	2.0	18	5.3	18	3.6	21	4.3	21	3.3
4	0	0.0	1	0.7	3	0.9	3	0.6	4	0.8	4	0.6
5	0	0.0	0	0.0	3	0.9	3	0.6	3	0.6	3	0.5
Total	151	100.0	148	100.0	337	100.0	488	100.0	485	100.0	636	100.0

reporting only administrative use. Just 11.3% have more than one computer and none have more than two. Among instructional only users, on the other hand, 26.8% are using more than one computer and 2.7% report use of more than two. Those reporting both uses show the greatest tendency to have more than one computer (36.5%), as might well be expected. In summary, data from this table show a higher degree of use of multiple computers among instructional users than among administrative users.

b. Arrangements for computer use

Table 9 reports data regarding the arrangements for use of computers by the various types of users (Groups C & D). The predominant arrangements for use are through leasing and purchasing time. However, it is interesting that almost one-fifth of the computers are owned by using schools and approximately one-tenth of the computers are used on a donated time basis. Instructional users, led by instructional only users, own a greater proportion of the computers they use than do other users and also have a greater proportion of computers being used on a donated time basis than other users.

c. Number of computer applications

Another measure of degree of use is the number of uses reported by each school (Groups C and D). Table 10 shows the number and percentage of schools reporting each number of applications by user category.

Among all users, almost half (590 schools) had only one application. Of course, this high rate is attributed to the large number of administrative only users. Therefore, when just the schools which reported instructional use are considered, a very different picture is revealed. Only 5.3% (35) of the schools report only one application. Conversely, 94.7% (631) report more than one application, 62.1% (414) report more than two applications, 33.3% (222) more than three, 15.4% (113) more than four, and 4.0% (26) more than five. One school reported nine applications.

Follow-up interviews at school sites suggested respondents tended to over estimate the number of applications in their schools:

Table 9. Arrangement for Use of Computers by User Category

Arrangement for use	Users: Admin. only N	%	Instruct. only N	%	Both N	%	All admin. N	%	All instruct. N	%	Total N	%
Owned	26	15.5	50	26.0	77	15.6	103	15.6	127	18.5	153	17.9
Leased	34	20.2	54	28.1	229	46.5	263	39.8	283	41.3	317	37.2
Purchased time	100	59.5	53	27.6	139	28.2	239	36.1	192	28.0	292	34.2
Donated time	8	4.7	35	18.2	48	9.7	56	8.5	83	12.1	91	10.7
Total	168	100.0	192	100.0	493	100.0	661	100.0	685	100.0	853	100.0

Table 10. Schools Reporting Each Number of Applications (10 Possible Applications) by User Categories

Number of Applications	Administrative only		Instructional only		Combined		All administrative		All instructional		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
1	555	100.0	35	17.9	--	--	555	54.1	35	5.3	590	48.3
2	--	--	68	33.8	151	32.1	151	14.7	217	32.6	217	17.8
3	--	--	54	27.7	138	29.3	138	13.5	192	28.8	192	15.7
4	--	--	35	17.9	84	17.8	84	8.2	119	17.9	119	9.7
5	--	--	2	1.0	75	15.9	75	7.3	77	11.6	77	6.3
6	--	--	3	1.5	17	3.6	17	1.7	20	3.0	20	1.6
7	--	--	0	--	4	0.8	4	0.4	4	0.6	4	0.3
8	--	--	0	--	1	0.2	1	0.1	1	0.2	1	0.1
9	--	--	0	--	1	0.2	1	0.1	1	0.2	1	0.1
10	--	--	0	--	0	--	0	--	0	--	0	--
Total	555	100.0	195	100.0	471	100.0	1026	100.0	666	100.0	1221	100.0

however, it is difficult to determine to what degree the number of applications was overestimated.

d. Student/ teacher involvement

Still another indication of the degree of computer use is reflected in the amount of student and teacher involvement in instructional applications (Group D). Data regarding the number of students and teachers participating in these applications, as well as the amount of time spent by each group in this regard, are presented in Table II (Group D).

Measures of central tendency and dispersion are shown in Table II. These are based on sums across applications, therefore, pertaining to each application. For example, the mean shown for student participants reflects the average number of student participants per application. This mean is not the average number of student participants per school since, as seen earlier, many schools have more than one application. This will be discussed later in more detail.

Table II reports both median and semi-interquartile range statistics, as well as mean and standard deviation statistics. Both types of statistics were reported to reflect the nature of the distribution of these variables. The distributions of all six of these variables were highly skewed in a position direction. This skewness results from a number of extremely high values being reported.

High positive skewness of this nature tends to distort the mean as a measure of central tendency in the direction of the high end of the distribution. Notice that in every case, the median of the distribution is lower than the mean. In essence, these distributions show that a large number of the schools reporting instructional applications are fairly closely grouped together at the lower end of continuum on each variable with a minority of the rest of schools spread over the rest of the continuum. They also show that 75% of 943 applications for which the number of students participating was given, report under 117 student participants, the remaining 25% report between 117 and 4,400 student

Table 11. Measures of Central Tendency and Dispersion for Variables Reflecting Student/Teacher Involvement in Instructional Applications

Involvement variables	N	Mean	Median	Standard deviation	Semi-inter-quartile Range	Range Minimum	Maximum
Student participants	949	126.3	50.4	307.8	45.8	0.0	4000.0
Teacher participants	759	3.0	1.0	6.0	1.1	0.0	46.0
*Hours of participation/student	766	13.3	10.7	11.1	8.8	0.0	80.0
*Hours of computer use/student	727	5.7	2.3	7.4	3.1	0.0	45.0
*Hours of participation/teacher	812	26.2	19.9	28.4	15.6	0.0	200.0
*Hours of computer use/teacher	736	7.4	4.2	9.9	4.7	0.0	98.0

*Per month

participants. To a slightly varying degree, the same is true of the other variables.

A good deal of variation exists within each distribution. This is largely due to the extremely high cases discussed earlier.

It should also be noted that these statistics are reported for all types of applications. The distributions for these variables differ widely from application to application. In addition, there is considerable variation within application types. Both factors account for the large dispersion for each variable.

The median number of student participants per application is 30.4 with about half (49.6%) reporting less than 30 participants. At the same time, 50% of all schools report at least 1.8 teacher participants per application with 1 teacher participant being mentioned most frequently (42.5%).

To extend the assessment of the degree of student/teacher involvement in instructional applications, schools were asked to report the amount of time devoted by each group. Schools reported the median of 10.7 hours of participation per month per student. Estimated roughly, the average student probably spends between 4-6 hours per day in class or approximately 90-120 hours per month. Therefore, a student participating in a computer application and falling at the median participant hours per month will spend about 10% of his time at the application.

It is interesting to note that although more schools (22.6%) report between 0 and 3 hours of participation per month per student, an almost equal number of schools report participation in each of the following ranges: 4-7 (19.3%), 8-11 (15.0%), and 20-23 (16.2%) hours per student per month.

The median number of hours of total participation during which each student actually uses a computer is 2.3 hours per month, with most schools reporting between 0-2 hours (53.6%). It is worth noting that some schools (2.5%) reported as much as 30-32 hours per student per month of actual computer use.

Participation among teachers shows a median of 19.9 hours per month per teacher with a modal response of 0-9 (29.8%). However, about 2/3 as many reported either 10-19 (19.8%) or 20-29 (17.2%). The hours of actual computer use by teachers are represented by a median response of 8.2 hours per teacher per month. Responses most frequently (53.4%) fell within the 0-4 hours per month range.

Both in hours of participation and hours of actual computer use, there is a 2-1 ratio of teacher hours to student hours. As the data reported here are based on a large number of schools, the skewness and wide dispersion noted in the distribution of all the participation variables is probably representative of the population of all schools using computers instructionally. In turn, the measure of central tendency is quite likely to be an accurate estimate.

These data were reported by single application rather than by school because, in a number of instances, many of the same students and teachers were involved in more than one application per school. Therefore, to sum the number of teachers and participants across applications within a school and report these data by school would have overestimated the number involved per school.

e. Computer time

Still another indicator of the degree of computer use is the amount of computer time being used. Questionnaire respondents (Group D) provided data regarding the total computer hours available to them each month and the number of hours per month during which they were actually running a program on a computer. In addition, postal card respondents indicated the frequency with which they used the computer (Group F).

Table 12 reports on the questionnaire data related to availability of computer time and actual computer running time (Group D).

Comments regarding the shape of the distribution of the student/teacher involvement variables shown in Table 11 also apply to the two computer use variables displayed in Table 12.

Table 12. Measures of Central Tendency and Dispersion for Variables Reflecting Amount of Computer Use for a Single Instructional Application

Computer use variables	N	Mean	Median	Standard deviation	Semi-inter-quartile range	Range minimum	Range maximum
*Computer hours available	640	96.3	60.0	116.6	59.6	1.0	840.0
*Hours of computer running time	722	50.6	25.0	67.9	28.2	1.0	760.0

*Per month

Schools report a median of 69.9 hours per month available per application, with many (35.3%) reporting between 1 and 39 hours. Additionally, they show a median number of hours of actual running time per month per application of 25.8. The distribution of this variable is bimodal, with the largest number of schools reporting computer running hours at the extreme ends of the continuum. Many schools (25.6%) report 95 or more hours per month and others (15.1%) report between 1 and 9 hours per month. Although comparison of these two medians does not provide an exact ratio of proportion of computer time available which is utilized, it reflects roughly a 40% usage of available time.

From the postal card survey (Group F) there are data from the 677 of the 853 instructional users who provided the information concerning frequency of use of a computer. Of these 677, there were 488 (72.2%) using a computer at least once a week, 109 (12.6%) once a month and 138 (15.2%) once during the school year.

3. Nature and purpose of instructional applications
(Basic Questions 19-23)

a. Instructional applications

This section deals with the major focus of the study--the instructional applications of computers (Groups B, E, F).

First, to place the discussion in context, Table 13 illustrates the number and percentage of schools reporting each instructional application and the percentage of total instructional applications represented by each (Group B).

Problem solving and ESP skills applications are by far the most popular among instructional users. The dominance of these two applications was confirmed during follow-up interviews (Group E). Quite frequently, these two applications occur together, even as part of the same course. The ESP skills training which was reported is basically of two types. First, the ESP skills training which occurs along with problem solving, aims at providing students with enough programming skills to solve mathematics, science and sometimes other types of problems. The

Table 13. Schools Reporting Each Instructional Application and Percentages of Total Applications Represented by Each Application by User Category

Application	Users: Instructional only — # Schools	Instructional only — %	Instructional only — % Application	Both — # Schools	Both — %	Both — % Application	All Instructional — # Schools	All Instructional — %	All Instructional — % Application
Computer assisted instruction	60	35.0	12.1	79	15.7	6.7	139	25.1	8.6
Problem solving	162	93.1	32.6	277	55.9	23.1	439	83.9	27.6
CAI skills	161	92.6	32.8	303	60.3	27.3	464	88.7	29.3
Gaming/ simulation	62	35.6	12.5	110	22.9	9.9	171	25.5	10.6
Mediated instruction	6	2.1	0.8	7	1.5	0.6	11	1.7	0.7
Other classroom	11	5.6	2.2	16	3.6	1.5	27	6.1	1.7
Management of instruction	36	8.2	3.2	82	17.6	7.6	98	16.7	6.1
Guidance and counselling	98	9.7	3.6	234	69.5	21.1	252	37.9	15.6
Other	2	1.0	0.4	3	0.6	0.3	5	0.8	0.3
Total schools	196	-	-	477	-	-	644	-	-
Total applications	495	-	-	1,108	-	-	1,601	-	-

second form of EDP skills training occurs less frequently and involves vocational training for students who wish to enter data processing careers.

Guidance and counseling applications were mentioned third most frequently. Follow-up interviews indicated that defining guidance applications which are instructional versus guidance-like administrative applications is a difficult task. It appears that many of the guidance applications reported may actually be more administrative in nature, involving class scheduling, grade reporting, etc. For guidance, the line between administrative and instructional applications is exceedingly fine. For example, there are a number of guidance applications which involve computer updating of student cumulative records. Determining whether such an application is an administrative record-keeping function or a computer-based academic and career counseling system may depend more on the ultimate use of the information rather than the functioning of the computer in the system. This same confusion exists with management of instruction applications. Here the question normally revolves around distinguishing between computer assisted scheduling and management of individualized instruction.

Fourth most frequently mentioned category was gaming and simulation. These applications involve both programs commercially produced and those produced by students and teachers for simulating such activity as baseball games, financial planning, space ship docking, etc.. Most of the gaming and simulation was done as part of the mathematics instruction in the school. More will be said about the purpose of these applications later.

Reported fifth most frequently was computer-assisted-instruction. Follow-up interviews revealed considerable confusion regarding this term. Schools tended to interpret CAI in a very general sense, thinking of it as any situation where the computer supports instruction. The definition provided with the questionnaire was considerably more restricted and followed closely the widely accepted interpretation of CAI. Interpreted in this way, CAI is programmed instruction on a computer, involving drill,

tutoring and dialogue between student and computer.

As a consequence of the broader interpretation given CAI by the respondents, it is likely that the number of CAI applications was overreported. However, CAI is probably still the fifth most popular instructional application in public secondary schools in the continental United States.

Next comes management of instruction, alternately referred to as computer managed instruction. Although there are indications from interviews that management of instruction is a rapidly increasing application, the number of these is not yet very large.

Mediated instruction was mentioned by only eleven schools. Follow-up interviews at several schools reporting mediated instruction failed to confirm the presence of this application. Mediated instruction, involving computer monitored and guided classroom instruction, may exist only at the college level. Applications mentioned in the "other classroom" and "other" categories occurred infrequently. Nature of these applications will be discussed later in the report.

6. Combinations of applications

It is revealing to analyze the frequency with which various applications occur together. Table 18 reports on the most frequently mentioned computer application combinations (Group 2). Administrative applications reported by instructional users have been included in this analysis.

The most frequently mentioned combination is guidance-administrative (18.1%). In light of the earlier discussions regarding the close relationship between these two types of application, this is not surprising. This combination forms the core of the non-classroom instructional/administrative grouping of applications.

The second most frequent combination is problem solving, CAI skills-administrative (12.8%). Looking at other combinations, one can see the high rate of co-occurrence of problem solving and CAI skills. As mentioned earlier, this combination dominates instructional use.

Table 30. Instructional Feature Requiring Various Combinations of Applications

Combinations	n	% of Schools
Guidance, Administrative	50	14.1
Problem solving, ERP skills	30	7.9
ERP skills, Administrative	20	5.1
Problem solving, Administrative	9	1.6
CAI, Problem solving	7	1.1
Problem solving, ERP skills, Administrative	61	12.0
Problem solving, ERP skills, Gaming/Simulation	21	5.6
Management of instruction, Guidance, Administrative	20	5.6
CAI, Problem solving, ERP skills	20	5.1
ERP skills, Guidance, Administrative	8	1.2
ERP skills, Gaming/Simulation, Administrative	7	1.1
Problem solving, Guidance, Administrative	3	0.8
Problem solving, ERP skills, Gaming/Simulation, Administrative	31	6.7
Problem solving, ERP skills, Guidance, Administrative	15	3.8
CAI, Problem solving, ERP skills, Gaming/Simulation	13	2.2
CAI, Problem solving, ERP skills, Administrative	12	1.8
Problem solving, ERP skills, Management of instruction, Guidance, Administrative	27	6.1
CAI, Problem solving, ERP skills, Gaming/ Simulation, Administrative	18	2.7
Problem solving, ERP skills, Gaming/Simulation, Guidance, Administrative	13	3.0

Table 16. Continued

Combinations	#	% of Schools
CAI, Problem solving, EDP skills, Guidance, Administration	6	1.2
CAI, Problem solving, EDP skills, Gaming/ Simulation, Guidance, Administration	6	1.2
Problem solving, EDP skills, Gaming/Simulation, Management of Instruction, Guidance, Administration	5	1.0
Subtotal of schools reporting these combinations	323	70.5
Schools reporting all other combinations	143	29.5
Total	466	100.0

*Those that appear 5 or more times are listed

problem solving and CAP skills form the core of classroom instructional applications. Additionally, schools reporting this combination of problem solving and CAP skills along with other instructional applications also have administrative use.

Another popular combination includes gaming and simulation, problem solving and CAP skills. If problem solving and CAP skills form the core of instructional applications, gaming and simulation applications are just outside this core.

CAI appears with considerable frequency in these combinations. However, as indicated earlier, school interviews did not confirm the high level of CAI applications reported on questionnaires. Therefore, it probably plays a less important role than is suggested by the data in Table 18.

The greater frequency of the combination of CAP skills-administration over the problem solving-administration combination may at first appear puzzling. However, two factors explain the more frequent occurrence of the former. First, CAP skills training occurs more frequently without problem solving than problem solving occurs without CAP skills. Students who are using the computer for problem solving will normally learn CAP skills first. Those receiving exceptional CAP skills however, will probably not do problem solving unless they are involved in it in mathematics or science classes. Therefore, CAP skills is reported more frequently as the only instructional application than is problem solving. Consequently, there are more opportunities for CAP skills to be linked with administration than for problem solving to be linked with administration. Additionally, in numerous schools, some administration functions (attendance, record keeping, etc.) are performed on computers by business students receiving CAP skills training. Therefore, these two types of applications occur together in these situations.

One other combination warrants comment. Management of instruction-guidance-administration occur in combinations with other applications as well as a combination of these applications. This combination forms the non-classroom instructional-administrative

group of combinations.

It can be concluded then, that there are two primary groups of applications. Problem solving-EDP skills form the core of a classroom instructional group and guidance-administrative form the core of a non-classroom instructional-administrative group. Each core combines with other secondary applications. Problem solving-EDP skills combine most frequently with gaming/simulation and CAI. Guidance-administrative combine with management of instruction. Be sure, these cores and their accompanying secondary applications combine with one another with varying degrees of frequency. The two longest combinations of applications most frequently reported are listed as the last two combinations in Table 16. These two combinations represent linking of the two primary cores along with their secondary applications. These popular combinations (occurring at least five times) account for the 78.5% of all combinations reported.

With a common understanding of what is meant by each application (definitions provided in PROCEDURE section), knowing how many schools are involved in each and how the applications occur in combination gives a fairly clear idea of the emphases in computer use in secondary schools. However, one can only draw inferences from this information about what students actually do when they participate in these applications and the purpose of the applications.

c. Active versus passive role

Through the questionnaires and interviews, information was gathered about activity and purpose for each application. Table 15 reports the frequency and percentage of schools which described the activity of students, categorized as shown for each classroom application (Group I).

Categories were constructed after analyzing responses. These responses describe predominantly active participation. As a result, only a few of the categories developed from these responses are even semi-passive (introduced to computer uses, learns a programming language). The more passive categories are highly general in nature. The active

Table 15. Instructional Users Responding to Each Student Activity Category by Application

Student Activity	CAI		Problem solving		EDP skills		Gaming/ Simulations		Other Classroom		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
Writes and runs programs			136	74.3	130	53.5	29	29.6	6	28.6	310	53.2
Runs programs	30	100.0	23	12.6	29	7.8	11	10.7	3	14.3	96	16.6
Writes programs			30	16.4	39	15.3	13	12.7	6	28.1	88	15.3
Debugs/analyzes programs			0	3.8	23	6.8	2	2.0	1	4.8	31	4.7
Keypunches			6	2.0	39	15.3	1	1.0			46	7.8
Flow charts			6	2.0	12	4.3	3	2.7	4	19.0	25	3.8
Introduced to computer uses					23	6.8					23	3.0
Learns programming			2	1.0	19	6.3			1	4.8	21	3.2
Operates EDP equipment					21	7.3					21	3.2
Plays games or simulates							62	60.8			62	9.6
Tests and practices	0	26.7									0	3.2
Discovers and demonstrates			0	1.0	2	0.7	2	2.0			0	3.2
Analyzes systems					0	3.5					0	3.6
Subtotal (Nonproblems)	30		210		205		102		23		650	
Omits	100	77.8	220	52.3	160	36.0	60	41.3	6	22.2	576	64.7
Total	130		430		464		170		27		1256	

*Some application types excluded because of insufficient responses

categories, on the other hand, describe specific behaviors.

The passive categories, if described more specifically, probably would involve at least semi-active participation. For example, the category, "introduced to computer uses" probably involves behavior like listening to lectures, studying computer texts, etc.

Interviews at schools confirm this emphasis on active participation, particularly emphasis on writing and running programs (Group E). In almost all applications, there is some lecturing during which students passively observe. However, teachers normally have students writing and running programs as soon as possible.

In only a few schools visited was there no formal course for learning how to program and solve problems on the computer. In these cases, students would read the materials on their own, and receive informal help from teachers in their spare time.

However, in the typical situation, there was a formal course for learning to use the computer. In these situations, the role of the teacher varied. In some cases, the teacher would lecture for several months before the students started interacting with the computer by running the programs they had written. In other situations, the students started off after the first week in their interactions with the computer. Usually the role of the teacher and student varied with the degree of access the students had to the computer. For a desk-top calculator or a terminal hook-up, the students could learn the basics and begin interacting with the system in a matter of days or weeks. However, with a school that only had access to a large expensive machine, which was paid for by the hour and was not available exclusively for the students use, the instructor would spend several months lecturing, and the students would spend many hours working on textbook exercises prior to their first interaction with the computer. After the interactions started the students had a great degree of flexibility in what they did and when they did it. In most cases, they had specific problems that they had to solve. Yet, when and how they worked on the problems was up to them and the assistance they received in solving the problems was largely informal and on an

individual basis. Also, students in many cases were encouraged to create and solve their own problems. Usually students worked on their own rather than in groups.

In a very few situations, students actually learned to operate the computer. Normally, the students learn to program and use the computer while someone else operates the computer to run their programs. It is common in these latter situations for the students to have a hands-on experience at least one time during the course. In many situations, students communicated with a computer through a terminal. It seems safe to say that most of the students who are involved in learning how to use a computer spend most of their learning time actually writing out programs, having them run, and revising them until they are correct.

Two situations do not fit into the above description and are both CAI applications. In these situations, the teacher helps the student learn a few basic skills on how to interact "on line" with the computer and the remainder of the time the student interacts completely with the computer terminal. Responses given for CAI applications on the questionnaire provide little information for describing the activity involved because they do not provide specific descriptions.

Overall, writing and running programs dominate student activities. Furthermore, this activity to a large extent, occurs in problem solving applications.

6. Purpose of computer application

The purposes given for the computer applications varied widely. They vary within applications as well as across applications. Some of the purposes given are very specific (reinforce arithmetic skills); most are relatively general (teach science, individualize instruction). At the same time, some responses were oriented toward subject matter (facilitate problem solving, teach programming). Others were concerned with teaching methodology or approach (motivate student, provide enrichment).

Table 16 gives the number and percentage of schools responding with the purposes listed for each of five classroom applications (Group

Table 14. Schools Responding with the Purposes Listed for Each Application Shown

CAI

	#	%
Teach programming, other DP skills	38	40.2
Reinforce arithmetic skills	19	21.6
Drill, practice and provide tutorial assistance	9	10.2
Individualize instruction, CAI	9	10.2
Remedial work	6	6.8
Teach science	2	2.3
Teach business	1	1.1
Motivate special-education students	0	0.0
Other	3	3.4
Total responses	87	

Problem solving

Teach problem solving	302	93.9
Facilitate problem solving using computer as a computational aid	66	20.5
Teach and practice programming and computer operation	46	14.4
Develop logical approach to problem solving through computer operation	37	11.6
Introduce computers	20	6.2
Teach math, science	13	4.1
Motivate and stimulate students' creativity	11	3.4
Other	26	8.1
Total responses	320	

DP skills

Teach computer programming	120	35.9
Teach computer concepts, an introduction to DP	83	24.8
Teach computer operation	48	14.3
DP skills (general response)	48	14.3
Provide vocational training	10	3.0
Motivate students in math and provide enrichment in math	10	3.0
Solve problems	6	1.8
Teach keypunching	5	1.5
Other	4	1.2
Total responses	334	

Gaming/Simulation

Teach theory, techniques of gaming, simulation, simulation of math models	28	25.7
Teach business and industrial operations, economic, social, other real-life situations through simulation	25	24.4
Motivate students and promote interest in computers	18	17.8
Teach, practice and enhance programming skills	14	13.8

Table 16 (continued)

Demonstrate capabilities and diversity of computers	13	12.0
Teach math concepts	6	5.6
Total responses	111	
Other classroom		
CAI skills - programming, operations, etc.	58	70.8
Problem solving	5	20.8
Gaming/Simulation	1	4.8
Total responses	20	

[a]Percentage of schools with the particular applications who responded to the purpose item in the questionnaire.

8). Only those applications shown in Table 15 are listed in Table 16.

Although many schools did not respond to the purpose questions, there are enough responses to identify some general trends.

Purposes listed for CAI provide insight into a problem presented earlier. Most of the schools responding (40.2%) indicated that the purpose of CAI was to teach programming or other EDP skills. It is possible that some of the schools may have CAI applications which teach these skills in a programmed instructional mode, but these are rare. Most of the respondents listing this purpose probably interpreted CAI in one of two ways:

1. A broad definition including instruction assisted by a computer in any manner.

2. The learning situation in which a student enters a program he has written into a computer through a terminal and receives output back from the computer indicating if the program compiled or assembled and if it didn't, why not.

The first interpretation was discussed earlier. In this case, the respondent has stretched the definition of CAI to the point that it can include any instructional situation in which the computer plays a role.

The second interpretation is less of a distortion of the meaning of CAI, but nonetheless, does not meet the definition of CAI. The student enters his problem solving program into a computer. The computer then feeds back to him, not whether his program will solve the problem, but rather whether his program can be operated on by the computer and if it cannot, what is wrong with it. Thus, there is two-way interaction between student and computer. After learning what is wrong with his program, the student must revise his program and return at a later time to re-enter it. In a sense, this is tutorial instruction. However, it is not in the programmed instructional mode, inherent in CAI.

The largest number of schools reporting problem solving applications simply stated that the purpose was to teach problem solving

(30.9%). Another 30.9% also give teaching of problem solving as the purpose by specifying one of two aspects: facilitating problem solving by using computers as a computational aid or developing a logical approach to problem solving through computer programming. The next largest number of responses (18.8%) was concerned with teaching programming and other computer operations. The category "Introduce computer" (6.2%) represents the purpose which focuses on the computer as the subject of instruction rather than as the tool of instruction as in the case with the responses just discussed. It should be noted that since schools gave more than one response, some of the schools which gave computer oriented responses probably also gave teaching of problem solving as a purpose.

All responses regarding the purpose of EDP skills center upon teaching about the computer except 3.0% of them which deal with motivating students and some non-categorizable responses. However, except for the 3.0% which specifically mentioned vocational training as the purpose of teaching of EDP skills, the majority of the purposes involve preparing the students for problem solving, gaming, etc. Other information from school interviews (Group C) suggests that most of this teaching is in preparation for using the computer as a tool.

Responses dealing with the purpose of gaming and simulation are fairly evenly distributed over six categories. Each category deals with a slightly different area. The most popular purpose (25.7%) emphasizes teaching of gaming and simulation theory and technique. The next most popular (20.8%) uses the technique and the computer as a tool to teach about real situations (business, social, etc.). Next, gaming and simulation is used as a motivational device (17.8%). The two subsequent response categories are concerned more closely with the computer: teaching, practicing and enhancing programming skills (13.9%) and demonstrating capabilities and diversity of computer (12.9%). Finally, some mentioned the teaching of mathematics concepts (5.0%).

School personnel participating in the interviews (Group C) were asked to give the overall purpose of the use of computers in their

schools. Many respondents gave several purposes for each application.

Using the computer as a computational tool for problem solving was given as the purpose by more respondents than any other (about one-fourth of them). Most problem solving was stated to take place in the mathematics and business areas. A slightly smaller number said the purpose was to teach students an appreciation of computers. Another quarter of the respondents emphasized the importance of developing logical thinking and mathematical ability. A somewhat small number of respondents specified the purpose as teaching about computers themselves. Some provided vocational skills training and others were simply attempting to generate an interest in computers as a career field.

Other scattered responses were concerned with preparing students for college, motivating students, and remedial instruction in specific school subjects (100 applications).

The results from the interviews support the conclusion that a computer is generally used in a supportive role in instruction. Emphasis is on teaching the content or skills of a subject matter. The computer is used as a computational aid, a motivator, or as an example of the nature of logical and numerical analysis rather than as the object of instruction.

e. Applications by subject area

The use of computers can be related to the school curriculum as a way of illustrating the nature and purpose of the instructional computer applications.

Respondents to the questionnaire provided information regarding subject areas in which computers were being applied (Group 3). Table 17 reports the number and percentage of schools listing each subject area involved in each application.

The subject areas were not always listed. For example, applications such as those in guidance do not deal with specific subject areas.

The dominance of mathematics in computer applications is clearly

Table 18. Subjects Leaving Each Subject Area for Each Institution

Subject Area	[illegible]		Fredricksburg		ECP		Hastings		Bakersfield		Other		[illegible]		[illegible]		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1. Math	69	21.3	161	49.7	127	39.4	79	24.4	3	04.0	3	04.0	6	75.0	2	40.0	340	19.3
2. Science	96	29.6	139	54.3	43	13.3	35	21.6	2	04.0	1	4.7	0	25.0	0	---	318	18.1
3. Business education	11	10.1	63	18.4	53	15.7	18	13.7	0	---	1	4.7	0	---	1	11.1	154	14.0
4. Data processing	13	13.3	26	9.0	130	39.3	31	23.3	1	20.0	3	14.3	3	75.0	2	40.0	229	13.1
5. English	7	2.4	3	0.3	2	0.6	7	5.3	1	20.0	0	---	0	25.0	1	11.1	43	2.3
6. Social studies	3	1.0	7	1.3	9	1.3	23	17.3	0	04.0	1	4.7	1	10.3	1	11.1	44	2.3
7. Foreign languages	6	3.7	2	0.3	1	0.3	6	3.3	0	---	1	4.7	0	---	0	---	17	1.3
8. Industrial arts and agriculture	0	---	5	1.3	2	0.6	1	0.7	0	---	0	---	0	---	0	---	8	0.3
9. Music and art	1	0.3	2	0.3	1	0.3	1	0.7	0	---	0	---	0	---	0	---	5	0.3
10. Health, safety, physical education	0	---	3	0.3	1	0.3	2	1.3	0	---	0	---	0	---	0	---	6	0.3
11. Library	1	.3	1	0.3	0	---	3	2.3	0	---	0	---	0	---	0	---	5	0.3
12. Other	2	1.3	9	2.3	8	2.3	12	8.3	0	---	1	4.7	0	---	1	11.1	33	1.3
Subtotal	319		361		377		239		9		23		8		9	---	1343	
Cache	23	13.3	40	11.3	127	27.3	31	13.3	6	34.3	12	33.3	31	21.3	2143	33.3	370	31.1
Total	339		429		504		270		11		37		39		2217		1713	

evident from Table 17. The presence of mathematics is most evident in problem solving and CAI applications (92.3% and 85.3%). However, even in CBP skills, mathematics is the subject area more frequently mentioned than any other, including data processing. The proportion of CBP skills applied in mathematics, sciences and social studies versus those in data processing and business education provides an indication of the emphasis of CBP skills training for use of the computer as a tool for learning an academic subject area (approximately 80%) versus CBP skill training for vocational preparation (approximately 55%).

When project staff members arranged school interviews, they asked to interview the individual in the school who was most familiar with the instructional computer applications. With few exceptions, the individual interviewed was a member of the mathematics department. From the history of instructional computer applications presented by interviewees, it is evident that these applications most frequently begin in the mathematics departments. If they spread throughout the school (frequently they do not) it is through the efforts of the mathematics department staff. In some cases, applications develop independently in separate departments (mathematics and business normally), but these cases are rare.

Why the applications have not spread more to other departments within a school is not clear. Interviewees (Group E) suggested that there is an easier acceptance of computers among the mathematically-oriented teachers. Teachers in other areas are frequently hesitant to undertake computer applications because of their unfamiliarity with computers and the assumed need for mathematical and electronic orientation to machines. However, it seems that fewer applications have been developed in non-mathematical subjects simply because the possible applications are not as readily apparent as they are in mathematical subjects. To effectively initiate a computer application in an English class, a teacher must be considerably more motivated than a mathematics teacher who is able to turn to a series of well established applications.

The majority of interviewees indicated that they had no problem integrating computers into their own curriculum. However, as just indicated,

when it comes to integrating computer applications into curricula outside of mathematics, problems are encountered.

Where integration has been smooth, most frequently one particular individual is given considerable credit. In one instance, this individual was a bright, ambitious student teacher who got teachers interested in computer work. Normally, the individual is the chairman of the mathematics department or another influential mathematics teacher. One school has a mathematics coordinator who is responsible for visiting classes and suggesting ways in which teachers might use a computer in their instruction.

Teachers commented that while one individual was the motivating force behind integrating computers into the curriculum, he was normally aided by one or more of the following factors:

1. A favorable attitude on the part of fellow teachers toward computers and teaching innovations in general.

2. A curriculum which was either quite flexible or in the process of being changed at the time that computers were being introduced to the school.

3. A cooperative administration willing to support the introduction of computer technology into the classroom. (Teachers commented that they had never let the administration down when it came to promises which they had made about computers. One business teacher attributed an increase in enrollment in the department's business courses to the enthusiasm generated by the presence of the computer. This increase in enrollment is counter to the national trend.)

Problems in integrating computer applications were most frequently traced to the reluctance of some teachers to initiate applications, as mentioned earlier. In addition, others mentioned problems with scheduling.

One scheduling problem centers around gaining sufficient access to a computer to accommodate all students. This problem is normally resolved by securing additional hardware. In some situations, it means scheduling of students so that full utilization is made of existing computer capability.

The other type of scheduling problem involves the curriculum

itself. Many schools indicated that they are faced with schedules for students which are packed with required courses. These courses cannot be replaced and there is not enough time left in the school day for any other courses. These required courses frequently deal with content on which students will be tested, on a standardized basis. Such lack of flexibility is particularly prevalent in scheduling of college bound students. Several teachers lamented the fact that they had been unable to introduce these students to computers because of the other traditional demands on their school time.

Several approaches to solving curriculum inflexibility have been attempted. Some schools have set up computer clubs and after school computer activities for students. Others have developed mini-courses which are conducted into the existing curriculum or given after school, for a short duration. Still others are turning to modular scheduling in an effort to put more flexibility into the curriculum. Modular scheduling involves short curriculum units permitting curriculum planners more time units with which to work and therefore more possible openings into which to introduce computer applications.

f. Integration of computers into the curriculum

Of the 933 schools which indicated instructional use on the postal card survey (Group f p. 919 provided information about whether they had a formal course in which a computer was used. Of these respondents, 619 (67.8%) indicated that they did have a formal course in which they were using a computer. This provides some indication of extent of integration into the curriculum.

In addition, from interviews (Group I), it is apparent that the presence of a formal course where a computer is used is not the only means by which a computer is integrated into the curriculum. Some schools simply use a computer as needed in a variety of courses. Others set their computer up in a laboratory and students use it there for a variety of course work as they desire. Despite the fact that no formal course has been established, these schools are making considerable use of computers. In such situations, teachers do not normally plan courses to include computers. Rather, students are the ones who choose to use computers.

Information regarding frequency of use of computers provides another indication of integration into the curriculum. Of the 933 instructional users (Group F) who responded to the postal card survey, 877 indicated the frequency with which they used a computer. Of these schools, 633 (72.2%) used a computer at least once a week, 109 (12.4%) once a month and 135 (15.4%) once during the school year. This indicates a fairly high frequency of use.

The grade level at which applications are introduced provides information regarding the nature of applications and the degree to which they are part of the overall school curriculum. Table 18 reports the number and percentage of schools introducing computer application at each grade level (Group G).

As a point of reference, it should be remembered that there were schools included in this survey population which had grades in addition to 9-12.

The modal grade in which applications are introduced varies between grades 9-11 from application to application. The most frequently mentioned grade of introduction across applications is grade 10. An encouraging sign from the standpoint of a person who might be promoting computer use is the fact that most applications (85.0%) are introduced before the twelfth grade. Therefore, the opportunity for students to be exposed to computer use for more than one year is present.

CAI shows the greatest dispersion of introduction, with three of the schools which most likely have grades 1-12, introducing CAI in the first grade.

The modal grade of introduction for EDP skills and gaming and simulation is one grade later than for CAI and problem solving. Other evidence indicates that when used in mathematics and science courses, EDP skills are taught prior to, or simultaneous with, problem solving. One explanation might be that the introduction of EDP skills as vocational training may tend to occur later than EDP skills in conjunction with problem solving. The validity of such an explanation would be interesting to test.

Table 10. Schools Reporting Each Grade to which Each Application is Introduced

Grade	CAI		Problem solving		CAP skills		Learning simulation		Other classroom		Guidance		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	3	2.0	1	0.3	0	--	0	--	0	--	0	--	4	0.6
2	1	1.0	0	--	0	--	0	--	0	--	0	--	1	0.1
3	0	--	0	--	0	--	0	--	0	--	0	--	0	--
4	0	--	0	--	1	0.3	0	--	0	--	0	--	1	0.1
5	1	1.0	1	0.3	0	--	0	--	0	--	0	--	2	0.2
6	0	--	2	0.6	0	--	0	--	0	--	0	--	2	0.2
7	16	15.2	21	6.0	19	5.9	6	4.8	5	15.2	5	20.8	71	7.8
8	3	2.8	11	3.4	8	2.6	5	4.0	3	9.1	0	--	30	3.3
9	17	16.2	58	17.7	32	10.6	16	12.9	11	33.3	7	29.2	141	15.6
10	35	33.3	103	32.5	89	29.4	32	25.8	7	21.2	3	12.5	269	29.6
11	16	15.2	81	24.8	107	35.3	39	31.4	5	15.2	6	25.0	254	27.7
12	13	12.4	46	14.1	44	15.2	25	20.2	2	6.1	3	12.5	133	14.7
13	0	--	1	0.3	2	0.7	1	0.8	0	--	0	--	4	0.4
14	0	--	0	--	0	--	0	--	0	--	0	--	0	--
Other	0	--	2	0.6	0	--	0	--	0	--	0	--	2	0.2
Subtotal	105	78.4	327	78.5	303	65.3	124	72.9	33	23.8	24	9.5	916	57.2
Units	29	21.6	112	25.5	161	34.7	46	27.1	120	76.4	229	90.5	680	42.6
Total	134		439		464		170		161		253		1600	

*So few responses were provided for mediated instruction, management of instruction and "other" that these applications are included with "Other classroom".

Table 19 presents medians and semi-interquartile ranges for each of six variables according to each of five instructional applications (Group D). These are not presented due to the insufficient number of responses for the other instructional applications. The first two variables reflect degree of student and teacher participation, while the last four variables are concerned with extent of student and teacher interaction with the computer. Before discussing each of these variables in turn, it should be stated that a good deal of variation exists within the data.

With respect to student participants, the largest median number of students per school is reported for guidance relative to the other four applications (99.5). Medians reported for teacher participants across the five applications differ by only 0.6 indicating that the number of teachers involved in each of the applications is relatively constant. While more students per school are involved in guidance, students on the average spend fewer hours per month (3.5) participating in guidance than for any of the remaining applications. The most hours per month are spent by students in the learning of EDP skills. The number of hours per month which each student on the average uses the computer is similar across the five applications. In general, teachers spend more time per month than students do irrespective of the type of application. Furthermore, the data for number of teacher hours of participation roughly parallels the data for number of student hours of participation. Teachers are involved more hours per month in EDP skills and fewer hours per month in the other applications. The fewest hours of teacher involvement per month are reported for guidance. Medians reflecting actual hours of computer use by teachers differ only slightly from one application to another. As would be expected, both students and teachers spend a small proportion of the total number of hours per month involved in an application actually using the computer.

6. Assessing computer skills

This discussion deals with the level of computer skill achievement expected of students involved in problem solving and EDP skills applications.

In most of the schools where interviews (Group E) were conducted, teachers have established some type of standards which they expect students

Table 19. Involvement of Students and Teachers in Each Instructional Application

Variable	CAI		Problem solving		ICAP skills		Gaming/ Simulation		Guidance	
	Median	Semi-Inter-quartile Range	Median	Semi-Inter-quartile Range	Median	Semi-Inter-quartile Range	Median	Semi-Inter-quartile Range	Median	Semi-Inter-quartile Range
Student participants	63.0	72.0	60.0	60.5	44.5	34.4	42.3	32.6	99.5	323.3
Teacher participants	2.1	1.6	2.0	1.4	1.5	1.2	1.6	0.6	1.7	3.0
*Hours of participation/ students	8.0	7.3	10.8	5.4	15.2	8.3	6.3	5.6	3.5	10.0
*Hours of actual computer use/ students	2.7	4.6	2.4	3.2	2.2	3.4	2.1	2.2	1.7	1.9
*Hours of participation/ teachers	17.4	16.8	21.5	13.6	25.6	15.9	9.7	1.1	6.7	6.8
*Hours of actual computer use/ teachers	4.1	3.5	4.6	5.0	4.5	5.2	3.4	3.3	2.7	1.6

*Per month

to meet. Some teachers indicate that students are expected to learn just the basics about computers. Other teachers indicated that students should appreciate both the capabilities and limitations of the computer and generally feel comfortable with it.

In the majority of the schools where the computer is used in mathematics and science classes, programming is taught as a tool for solving problems and as a vehicle for studying the logical approach to problem solving. Students learn just enough programming to aid them in solving problems. This is not to say that this is the maximum performance obtained from all students. According to every teacher interviewed, some of the students go far beyond what is expected of them in terms of programming. Many, in fact, develop programming skills far superior to those of the teachers. In these situations, teachers must have enough self-confidence in their ability and knowledge as mathematics or science teachers not to be disturbed by students who know more than they do about programming. Some teachers are probably unable to face such a situation and this may explain why they do not utilize a computer in their teaching.

Some schools offer courses designed to provide vocational training in keypunching, machine operation and programming. There are students completing these programs who do get jobs as keypunchers and beginning machine operators. A few students even obtain jobs as junior programmers.

More than one teacher said that some students in college preparatory courses become so engrossed with programming that their performance in other courses suffers. In addition, some are diverted from attending college by the attractive salaries paid in the computer industry. This effect on overall achievement is an important one and will be described in more detail later.

In a fair number of schools where interviews were conducted, no specific or formal computer achievement level was set for students. The computer was provided as a tool for students to use as needed or as an enrichment to their basic subject areas (normally in mathematics). In these cases, students were at liberty to spend as little or as much time

with a computer as they cared to. Achievement level therefore, was largely determined by the student himself. In these situations and others where the computer was used more systematically in class work, it was common for some students to spend many free periods and after school hours with a computer.

The most frequent achievement standard for a student is to be able to write a program, debug it and have it run successfully on a computer. In addition, they frequently are required to document their programs with a flowchart.

b. The effect of the use of computers

Because there is a general lack of systematic evaluation of computer involvement in instruction it is difficult to assess the effect on student achievement (interview results, Group E). One notable exception is one mathematics teacher who plans to perform a controlled study over the next two years to empirically determine the effect of a computer on the achievement of students in mathematics classes in his school. Most teachers have a feeling that it brings improvement to this instruction. Their claim, it must be said, is impressively supported by logical and anecdotal evidence. For example, they point out that it is only reasonable to expect a student to grasp the concepts behind a solution to a problem if he has written a program to produce the solution. He spends his time analyzing the problem and developing a solution; not in the tedious task of performing the arithmetic required to arrive at an answer. A computer does the arithmetic for him. Anecdotal evidence comes from interviewees who were asked to identify what the computer contributed to the learning process in the school setting. Teachers told many stories about students whom they had tried to reach or motivate many times, and in many ways. They had failed until they introduced the students to computers. From this point on, these students not only learned a lot about computers, but they learned more about the subject matter of the course.

One teacher cited the dramatic case of one young individual classified as an educable mentally retarded student, who advanced three years in mathematics skills in one semester of working on a computer. There

are other examples of students who teach themselves programming languages other than those taught in their courses, students who have won national awards for their programs, and a student who wrote a software manual while at home nursing a broken leg.

These and other stories illustrate the motivational effect that a computer has on some students. It is important to remember that this effect is not universal. There are students left uninspired by the computers or even negatively affected. At many schools, interviewers were told that in courses in which a computer was used extensively, students either became deeply involved and excited about computers or completely rejected computers and asked for a transfer to a non-computer oriented course. How and why such a dichotomy occurs in some instances is an interesting question for psychologists and educators to study.

Some teachers warned that the motivational effect of computers may be temporary, lasting only as long as the novelty lasts. Others see a more permanent motivational effect. The latter group points to the "hands-on-experience" as the important feature of computer work which motivates students. Several teachers indicated that the computer as a motivator had gone a long way to cure "senioritis" in their school (the tendency for students to regress in achievement during their senior year.)

Other features of computers which contribute to the learning process are closely linked to the motivational aspects. The feedback, for instance, which students get from their computer interaction seems to be an important factor in the learning process. As the student works, he receives immediate feedback from the computer which he can use to assess his progress and determine what he is doing wrong. Frequently in traditional classroom situations, such feedback is not evident. Feedback of this type may be particularly important to the so-called "slow" learner. For the first time he can see the results of his work and is reinforced for accomplishing something.

For many students, especially the very bright ones, the computer presents a challenge, possibly the first challenge they have faced since entering school. The students soon learn as much as possible about the

tremendous capabilities of computers. In some schools surveyed the challenge posed by computers was met in misdirected but interesting ways. For example, in one school, students discovered a way to manipulate the functioning of terminals at other schools through their own terminal. They were then able to turn other terminals on and off at will. Although this creativity was misdirected, it nonetheless was creativity, required to large measure to perform such an act.

The computer contributes to learning of problem solving, logic, and decision making. The logical assumption is that if a student can write a computer program to solve a problem or simulate a situation on a computer, he will understand the problem or situation better. This notion is borne out by casual observations of teachers interviewed. The degree of understanding required to write a successful computer program to solve a problem is far greater than that required to carry out the hand calculation necessary to solve the same problem.

In addition, the computer as a computational aid takes the drudgery out of mathematics and provides more time for learning the more important concepts and developing the capacity to think through and analyze problems logically. In this regard, one teacher commented that computers make mathematics relevant. The opportunity for the student to tackle real problems which may require huge amounts of calculation is available because of the capacity of computers to perform these calculations.

With CAI, the capacity to individualize instruction is available. Students can work at their own pace and with considerable individualized attention. The "slow" student does not have to face the embarrassment of competing in the group and the fast student is not held back by the group.

One final comment, which may raise more interesting research questions, concerns competition and cooperation in instruction. Some teachers pointed to the learning benefits gained when students compete with one another in programming their computer. Still others pointed out that students cooperate and help one another more in working with the computer than in any other instructional activities. In several cases, this has led to students becoming teacher assistants even to the point in one school

where students develop and administer computer programming achievement tests to other less advanced students. The dynamics which lead to competition or cooperation in these classes, plus the effect of each, appears worthy of further study.

1. Sources of software

Two other questions also concern the nature of instructional use. These deal with who prepares software for applications and which programming language(s) are used. In Table 20 the number and percentage of schools indicating each software preparer for each application are reported (Group B).

Overall, teachers most frequently (39.2%) participate in the preparation of software for computer applications. Mentioned second most frequently (26.8%) is a computer specialist outside of the school. These situations normally involve applications in which "canned programs" are used. Next most frequently mentioned (19.4%) is the student. No other preparer of software comes close to matching the involvement of these three top categories.

Except for guidance applications, where computer specialists outside of the school do most of the software preparation, teachers, computer specialists outside of school, and students occupy the same relative position for all applications.

In problem solving and EDP skills, the most common activity among students, as we saw in Table 15, was the writing and running of programs. Software preparation by teachers and outside specialists involves, in most cases, development of curriculum materials, as well as some programs which are used as samples of problem solving. There are also some problem solving and EDP skills applications in which students do not write programs but may run others generally written by teachers or outside specialists.

In the interview (Group E), teachers were asked whether curriculum materials were developed in the school or outside. Their responses indicate that materials used in any one school tend to come from a wide variety of sources.

Table 22. Schools Indicating Each Software Response for Each Application.

Response	Application															
	CAI		Problem solving		ESP skills		Gaming/ simulation		Other classroom		Management		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Student	18	18.0	96	33.2	76	29.2	37	31.4	4	16.0	2	18.2	1	3.4	234	27.9
Teacher	55	55.0	170	58.8	169	62.8	59	50.0	11	44.0	5	45.4	4	13.8	473	56.2
Administration	7	7.0	11	3.8	14	5.2	3	2.5	3	12.0	1	9.1	5	17.2	44	5.2
Computer specialist in school	5	5.0	11	3.8	13	4.8	7	5.9	2	8.0	2	18.2	9	31.0	49	5.8
Computer specialist out of school	39	39.0	115	39.8	104	38.7	46	39.0	6	24.0	3	27.3	11	37.9	324	38.5
Other-out of school	1	1.0	3	1.0	2	0.7	2	1.7	0	--	1	9.1	1	3.4	10	1.2
Unspecified computer specialist	4	4.0	13	4.5	12	4.5	11	9.3	5	20.0	0	--	0	--	45	5.4
Other	4	4.0	10	3.5	8	3.0	4	3.4	0	--	0	--	2	6.9	28	3.3
Subtotal	100		289		269		118		25		11		29		841	
Omits	34	25.4	150	34.2	195	42.0	52	30.6	18	42.0	87	88.8	223	88.5	759	87.6
Total	134		439		464		170		43		98		252		1600	

* So few responses were provided for assisted instruction and "other" that these applications are included with "other classroom".

Most two-thirds of those interviewed had developed some of their own curriculum materials. The majority of the material from the outside had come from hardware companies. Other sources included school systems (through curriculum projects), students, NSF institutes and projects, universities, and other public and private sources.

8. Programming Languages

The next issue concerns the programming languages which are used for the various applications. Table 21 displays the number and percentage of schools reporting programming languages for each of the applications (Group 8).

Table 21 shows that overall, FORTRAN is the most popular programming language (40.7%). BASIC ranks second (38.2%). Other programming languages, including LPL, Coursewriter, regional variations on compiler languages and machine languages, are next (29.2%). Unspecified assembly languages for various computers were reported for 13.6% of the applications and Autocoder for 5.0%. These latter two taken together account for a total of 19.2% of the applications for which an assembly language is used.

There are important variations from application to application which deserve comment. For CAI applications, a wide variety of programming languages are reported. BASIC and FORTRAN are reported most frequently for CAI (35.6% and 30.6%). As seen from Table 21, these programs are most frequently written by teachers and computer specialists.

With problem solving, gaming and simulation, and CMP skills applications, students do a fair share of the programming. For problem solving and gaming and simulation, FORTRAN and BASIC dominate. For CMP skills, FORTRAN, BASIC and "other" are most prevalent. In each of these cases, the fourth most prevalent language is an assembly language, either Autocoder or "unspecified."

There is a controversy among schools regarding whether students just learning to program should start with an assembly language or a compiler language. Those who favor the compiler languages claim that learning an assembly language takes too long for their purposes. These

Table 27. Schools Indicating Each Programming Language* for Each Application.

Programming Language	Application															
	CAI		Problem solving		ADP skills		Computer Simulation		Other classroom		Management		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
FORTRAN	24	34.3	141	32.3	168	37.7	68	42.5	13	37.1	3	18.8	7	4.8	466	40.7
BASIC	29	37.6	138	31.6	84	37.8	49	40.2	9	42.9	4	66.7	1	16.7	314	34.7
COBOL	2	2.9	6	2.3	34	8.9	3	4.3	1	4.8	2	25.0	4	8.0	47	5.2
ALGOL	1	1.4	4	1.7	3	1.0	2	2.4	0	---	1	16.7	1	2.9	22	1.8
PL/1	0	---	7	2.8	13	4.3	2	1.8	0	---	0	---	0	---	22	2.3
APL	4	4.3	8	3.1	4	1.4	3	3.4	0	---	0	---	0	---	19	1.9
Other(under)	2	2.0	5	2.4	10	3.4	2	1.5	0	---	1	16.7	20	80.0	14	1.4
Unspecified assembly	20	31.4	47	12.2	44	11.2	20	16.4	0	---	0	---	0	---	129	21.4
Other	24	18.9	83	18.1	96	31.0	36	29.3	0	42.8	5	37.4	13	24.3	261	22.2
Subtotal	96		341		291		112		23		13		30		977	
Omits	36	26.9	94	21.4	173	37.3	48	29.2	22	33.3	58	68.8	252	88.2	663	41.9
Total	134		439		464		170		45		96		292		1640	

* In the responses were provided for assisted instruction and "other" that these applications are included with "Other classroom".

teachers are normally involved in problem solving applications and want students to learn the necessary programming skills to solve problems as quickly as possible since the object of instruction is learning problem solving, rather than learning about computers. Teachers favoring assembly languages on the other hand are focusing upon the computer as the object of instruction.

It is true that those involved in problem solving emphasize the importance of learning logical solution methodology, but they feel that the logic of compiler language provides the needed understanding of systematic solution of problems.

6. Use of computer time

Medians and semi-interquartile ranges are shown in Table 22 for two variables concerned with the nature of computer running time for the same five instructional applications which are included in Table 19 (Group 2). Again, a fair amount of variation is present in these data.

Consideration of actual computer running time in hours per month by application indicates that more time is spent proportionately for CAI, problem solving and EDP skills than for gaming and simulation and guidance. The computer is used the fewest hours per month for guidance. Of the total amount of time the computer is running, some lesser amount of time is devoted to use of the CPU. For CAI, the percentage of CPU time is the largest while for both EDP skills and gaming and simulation applications the lower percentages are reported.

6. Level and source of support of instructional use

a. Estimated costs

It is generally believed that a good deal of money is being spent on computer applications in secondary schools in the United States. At the same time, it is very difficult to get an accurate estimate of this cost. This difficulty is reflected in the fact that only 322 of the 933 instructional users who completed the questionnaire (Group 2) were willing or able to provide information regarding the cost of computer use. During interviews (Group 1), most teachers indicated that budgetary matters

Table 22. Nature of Computer Running Time for Five Instructional Applications

Applications	Variable			
	*Actual Computer Running Time		*Percent CPU Time	
	Median	Semi-interquartile range	Median	Semi-interquartile range
CAI	32.0	26.8	53.7	37.0
Problem solving	31.5	34.4	44.1	32.6
ESP skills	30.7	32.8	28.9	31.5
Gaming/Simulation	18.9	22.6	29.9	40.4
Guidance	12.0	16.8	37.0	9.5

*Per month

concerned with computing costs were dealt with by administrators, many of whom were not located in the school. Therefore, even when costs are given, they frequently are estimates.

These estimates will vary in terms of exactly what is included as a relevant cost item. Most frequently, the personnel cost of a teacher is not included. Individuals reporting these data frequently reasoned that since teachers were already being paid out of the regular school budget, their time could not be charged to any computer application.

In any event, schools did report their "total annual budget for instructional applications of computers" (Group D). The median cost reported was $13,999.50. Considerable variation in this item was shown. The lowest computer budget reported was $0.00 (costs considered were covered by an outside source). The highest computer budget reported was $840,000. How these costs would change, if all schools had included teacher and other staff costs, is difficult to estimate. It is interesting to observe that the 322 instructional user schools providing their computer budgets report a grand total of just over $5 million in expenditures for instructional computer use compared to the approximately $3 billion in expenditures for the total annual operating budgets of these schools. Therefore, out of every $100 educational dollars spent by these schools, less than 20 cents goes toward instructional computer use. For each school reporting these data, the total annual operating budget was divided into the annual computer budget. The median percentage of the total annual operating budget represented by the annual computer budget was .4%. This percentage ranged from .06% to 20% for all schools which reported a computer budget. This is a small expenditure particularly when it is considered that these figures are for only those schools using computers for instructional purposes.

b. Sources of support

In addition, the questionnaire was designed to gather information about where the funds come from. Based on information reported by 322 schools, Table 23 shows the amount and percentage of the total computer budget contributed by each source shown (Group D).

A strong dominance of local funding of instructional computer

Table 23. Contributions By Source of Funds
for Instructional Computer Budget Reported

Source of support	Amount	Percentage
Local	4,080,000	80.3
State	260,000	5.1
Federal	340,000	6.7
Other	400,000	7.9
TOTAL	5,080,000	--

applications (80.2%) is illustrated. From discussions with teachers (Group E) who provided some of these data, it is possible that they may have attributed some funds to local sources when in fact the funds originally came from state, federal or "other" sources. However, data related to sources of support for the school total annual operating budget show a mean response of 66.5% contributed by local sources. This percentage is not far from the 53.7% contribution attributed to local sources for all public elementary and secondary schools in the U. S. in 1968-69 (Simon and Grant, 1968). Teachers' estimates of local contributions to computer budgets probably is not far off the mark.

Table 24 shows the median percentage per school computer budget contribution by each source. (Group D). These data show that per school the median percentage of the computer budget contributed by state sources slightly exceeds the median federal and "other" contributions. On the other hand, the federal and "other" contributions account for a larger percentage of the total dollars for instructional computer use reported by all 322 schools (Table 23). This difference is due to the larger contributions of federal and "other" funds to large instructional computer budgets and the larger contributions of state funds to smaller schools. Therefore, although the median federal contribution is only 2.4% per school computer budget, it is contributing larger percentages to the larger computer budgets. In other words, there is a greater tendency for schools with large instructional computer budgets to be receiving federal and "other" support than schools with small instructional computer budgets. It may be that the differences in the computer budgets of these schools can largely be attributed to federal and "other" support.

Data were also gathered about the source and amount of support for specific application types. Table 25 shows the number and percentage of schools reporting each source of support for each application.

For all applications, combined local sources of funding account for 63.5% of the sources named. In discussing sources of funding earlier, it was pointed out that the school staff does not always realize that funds provided by local sources may have come originally from state, federal, or

Table 24. The Median Percentage Per School Contributed to Computer Budget By Each Source

Source of support	Percentage	
	Median	Semi-interquartile range
Local	95.4	20.2
State	2.8	1.6
Federal	2.4	1.4
Other	2.2	1.3

Table 25. Schools Reporting Each Source of Support for Each Application

Application	Source													
	Local	State	Title III	Headstart	Title I	ESP	Coll. or Univ.	Local Bus.	ESEA	Voc. Educ. Act	Indian	ITAP	Other	Total
Art	40	2	5	1	1	10	3	---	5	1	1	1	1	71
	*10.4/	6.5/	13.5/	7.7/	11.1/	23.8/	9.7/	---	31.2/	10.0/	20.0/	33.3/	6.6/	
	**56.3	2.8	7.0	1.4	1.4	14.1	4.2	---	7.0	1.4	1.4	1.4	1.4	11.0/
Problem solving	143	10	13	6	6	17	16	2	6	9	3	---	4	224
	37.5/	34.5/	31.0/	30.0/	66.6/	60.5/	51.6/	66.6/	37.5/	90.0/	60.0/	---	26.6/	
	63.9	4.4	5.8	2.6	2.6	7.5	7.1	1.3	2.6	4.	1.3	---	1.8	35.0/
ESP skills	127	13	15	5	3	7	8	1	2	4	---	---	5	190
	33.2/	44.8/	34.8/	38.5/	33.3/	16.6/	25.8/	20.0/	12.5/	40.0/	---	---	33.3/	
	66.8	6.8	7.9	2.6	1.6	3.7	4.2	0.5	1.0	2.	---	---	2.6	29.7/
Testing/ Simulation	30	3	7	1	1	4	4	---	2	2.	3	---	3	70
	13.0/	10.3/	16.2/	7.7/	11.1/	9.5/	12.9/	---	12.5/	20.0/	60.0/	---	20.0/	
	04.1	3.8	5.0	1.3	1.3	5.1	5.1	---	2.6	2.6	3.8	---	3.8	10.9/
Other classroom	***23	1	2	2	---	4	---	1	1	---	---	2	2	39
	6.0/	3.4/	4.6/	15.4/	---	9.5/	---	20.0/	6.2/	---	---	66.6/	1.3/	
	61.5	2.6	5.1	5.1	---	10.5	---	2.6	2.6	---	---	5.1	5.1	6.1/
Total	363	29	42	13	9	42	31	5	16	10	5	3	25	619
	/63.5	/4.8	/7.0	/2.2	/1.5	/7.0	/5.1	/0.8	/2.6	/1.6	/0.8	/0.5	/2.5	

* Percentage of total times application mentioned for each source.

** Percentage of total times source mentioned for each application.

*** Other combines other application for which sources are mentioned.

private sources. However, the dominance of local support is still quite impressive. The next four most frequently mentioned sources are MSF (7.8%), Title III of the Elementary and Secondary Education Act (7.0%), colleges and universities (5.1%), state (4.8%). These sources dominate the non-school system sources.

Looking next at the total sources mentioned for each application, the greatest number of sources mentioned are for problem solving (37.5%) and CAP skills (31.5%). These results reflect the dominance of these applications in secondary schools.

The next point to consider is whether the pattern of sources of support for specific applications differs from the overall patterns just described. Analysis of Table 25 indicates that if the sources of support are ranked separately for each application, the rank order of sources would coincide closely with the rank order of each source for all applications combined. That is, for each application, local is named as the source of support most frequently, MSF next, Title III third, etc. In fact, the percentage of schools which named these sources for each application closely corresponds to the three percentages shown for all applications.

In addition, the rank order of applications remains fairly constant from source to source. For example, the dominance of problem solving and CAP skills is as prevalent among local sources of support as among college and university sources. The conclusion then is that generally the pattern of emphasis on specific applications, in terms of number of times sources are mentioned, does not vary much with the source of funds.

Three minor exceptions to this general conclusion should be noted.

There is a greater percentage of schools receiving support for CAP skills training and problem solving from state and Title III sources than is generally found for all sources combined; the emphasis on problem solving is even greater than the general pattern among MSF, college and university sources, and the number of schools listing MSF as the of support for CAI applications is greater than the general trend for this type of application.

c. Level of support

Discussion turns now to the level of support for specific instructional applications. Table 26 presents the frequency distribution for amount of support for each type of application (Group 3), i.e., the annual level of support for specific type of application. These data show level of support per application for all sources of support listed for the application. When all application types are combined, the median funding level from sources given for a single application is $977.20. Therefore, a typical application is receiving approximately $1,000 in support from the sources listed. It should be indicated that schools may not have listed all of the sources from which funds were received. A check of the data however reveals that this median of approximately $1,000 is a fair estimate of the support being received for a single application.

Analysis of individual application medians shows some variation from the overall median. The median for problem solving applications is somewhat higher than the general median. The funding of single applications is generally dominated by fairly small amounts of money, about $1,000 per application. It is noted however that 16.3% of the applications are receiving support above $5,000,8.4% above $10,000, and 1.8% above $50,000. The large majority of these cases involve problem solving and EDP skills applications.

d. Cooperative computer use

Another means of supporting computer use is through some type of cooperative arrangement. Cooperative arrangements for supporting and developing computer applications exist throughout the country. These arrangements may support computer operations through funding, by providing computer facilities or by sharing information. These cooperative arrangements exist between secondary schools and each of the following:

School systems
Colleges and universities
Commercial networks
Formal networks centered around a university

Table 15. Amount of Annual Support for Types of Applications

Application	Amount of Support: $1-100 N	$1-100 %	101-500 N	101-500 %	501-1,000 N	501-1,000 %	1,001-5,000 N	1,001-5,000 %	5,001-10,000 N	5,001-10,000 %	10,001-50,000 N	10,001-50,000 %	Sum	Mean	Median	Semi-interquartile Range
Cell	5	17.9	4	14.3	7	25.0	9	32.1	1	3.6	2	7.1	28	1145	139	$257.63	1,451.10
Fertilizer Existing	7	8.1	16	18.6	13	16.3	34	39.5	9	10.5	5	5.8	97	350	450	$350.30	1,950.01
ESP Skills	6	8.8	17	24.3	12	21.6	18	25.7	6	8.6	8	11.3	70	726	464	$440.50	1,991.70
Boating/ Simulation	6	21.4	6	21.4	6	21.4	9	32.1	2	6.7	1	3.3	30	140	139	$50.50	1,450.00
Other Classroom	1	5.7	5	28.5	2	11.4	5	28.5	--	--	--	--	13	125	139	$25.50	1,450.00
Total	25	11.4	48	21.4	40	18.8	75	34.2	18	7.9	13	6.3	228	1119	1346	$57.63	1,970.30

or some other facility
Other schools

The financial support coming out of these cooperative arrangements was touched on earlier in this section. Other cooperative arrangements also exist where schools are sharing computer facilities, staff, information or all three. The nature of these cooperative arrangements is varied. In those cases where cooperation involves sharing of a computer, the arrangements tend to be formal. These formal arrangements are normally known as computer networks. Quite frequently they are being funded by a common source. Other networks are less formal and often may involve only the sharing of information.

During school interviews, teachers were asked about the cooperative arrangements in which they were involved (Group I). About 52% of the schools are involved in no formal cooperative arrangements.

Approximately 18% do belong to one or more formal networks. These can be divided into two basic categories--those which emphasize computer usage and those which include computer usage as one aspect of their overall program. Those falling into the first category include: computer conferences with other schools, Districtwide Computer Education Committee, Computer Instruction Education Committee, Computer Instruction Network (CIN), BOCES, TIES, Project LOCAL, Computer Usage for Suburban and Coastal Connecticut, Huntington Park Project, Dartmouth Network, and Digital Equipment Corporation Computer Usage (DECUS). The second category is primarily educational organizations which include sharing information about computer applications. Those mentioned are: subsidiary groups of the Connecticut Educational Association, Association of Business Education and State Department of Education Advisory Committee. A somewhat different arrangement is made possible by Public Law 28 in California, which allows high school students to take courses at junior colleges and receive high school credit.

Nearly 75% of the respondents have cooperated at least once with outside sources to share information on at least an informal basis. In some cases, schools have given out course materials and advice and shown

their installation to others. In other instances, school officials have sought information by visiting other schools, through arrangements with local colleges, and through visiting business representatives. Personnel at one school helped in the creation of an intermediate educational district which is designed to coordinate activities among schools in the area. A number of schools got together to write proposals for original funding of their applications. Schools in Nassau and Suffolk Counties in New York State are beginning to set up facilities for sharing information.

The preceding discussion is not exhaustive. It includes just examples of cooperative arrangements which exist throughout the U. S. which were mentioned by staff at visited schools.

e. Commitments to computer use

Besides the financial investments of schools discussed earlier, there are other means for assessing the commitments which schools have made to computer use. Commitments involve the degree to which computers have been integrated in the curriculum, the number of members of the staff who are trained for computer use, and the degree to which the computer has been accepted organizationally by the school.

Earlier, data regarding the integration of computers into the curriculum was discussed. It is evident from data presented in Table 17 that the computer has been quite thoroughly integrated into the mathematics curriculum. However, beyond the mathematics curriculum the acceptance of computers has been considerably less rapid and thorough.

Respondents to the questionnaire cited the number of teachers on the staff of each school who had received training in computer use (Groups C and D). From a reading of Table 27, it is evident that generally there are a limited number of teachers trained in computer use per school. Interviewees indicated that training of teachers was one of their greatest needs in order to continue their applications (Group B).

The training which teachers have obtained was sponsored and conducted by a variety of sources. Table 28 presents data relevant to this point (Groups C and D).

Table 27. Computer Users Reporting Number of Staff Trained in Computer Use

Number of Staff Trained in Computer Use	Subsets Reporting	
	N	%
0-4	954	86.0
5-9	111	10.1
10-14	22	2.0
15-19	8	0.7
20-24	3	0.3
Over 24	1	0.1
Subtotal	1099	---
Omits	122	10.0
Total	1221	---
Median	2.83	---
Semi-inter. range	1.44	---

Table 28. User Schools Reporting The Type of Organization which Conducted and Sponsored Training

Organization	Conducted		Sponsored	
	N	%	N	%
Technical or computer school	37	6.7	37	5.2
College or university	403	61.5	222	31.3
Computer manufacturer or other commercial source	220	33.6	170	24.0
NSF	---	---	154	21.7
U.S.O.E.	---	---	28	3.9
Other federal agency	---	---	22	3.1
Other	113	17.3	102	14.4
Subtotal	655	---	709	---
Omits	566	46.4	512	41.9
Total	1221	---	1221	---

Most schools reported that colleges and universities conducted and sponsored the training of teachers in their schools. The next most frequently mentioned conductor and sponsor was computer manufacturers. NSF and computer manufacturers are very close in the rankings as sponsors of computer training. It should be noted that in many cases, the training conducted by colleges and universities is sponsored by other organizations, frequently federal goverment agencies.

Users of computers responding to the questionnaire indicated whether they had a center or focus of responsibility for coordinating computing activities in their schools. Of those providing this information, 763 (63.4%) indicated that they did have a center of responsibility. This high percentage of affirmative responses indicates a high level of organizational support of computer use.

B. School Characteristics and Use of Computers

Before discussing previous use of computers reported by schools, the instructional users of computers will be compared to those schools which do not use computers instructionally (administrative only users and nonusers) (Group B).

Table 29 reports data regarding certain demographic characteristics of the two school samples under discussion. For the variables of enrollment (size of school), number of teachers, percent of high school graduates attending college, and percent attending junior college, medians are higher for schools with instructional applications than for schools without instructional applications. For both the enrollment and teacher variables, medians for instructional user schools are roughly twice the size of the medians for other schools. There is a tendency for a higher percentage of graduates of schools with instructional applications to attend college and junior college. The differences in median size on these variables between the two school samples however is not large. The percentage of students continuing their education in technical school is similar for both school samples. The schools which use computers seem to be characterized by a higher enrollment and more teachers as compared to schools which do not use computers.

Table 29. Demographic Characteristics of Schools With and Without Instructional Applications

Characteristics of School	All Instructional		Other	
	Median	Semi-interquartile range	Median	Semi-interquartile range
Student enrollment	1347.4	576.8	636.0	400.0
Number of teachers	69.2	27.2	33.6	16.3
Percentage of graduates going onto:				
College	40.3%	14.4	35.0%	12.2
Junior College	14.7%	8.8	11.3%	7.8
Technical School	7.9%	5.5	8.8%	5.9

Additional data regarding demographic characteristics of the school types 'all instructional' and 'other' (administrative only users and nonusers) are presented in Tables 30, 31, and 32 (Group B). Table 30 shows frequency and percent of respondent schools which fall into each of the six school type categories as well as the number and percent of 'omits' relative to the total. For both 'all instructional' and 'other' samples, most schools are comprehensive. However, more instructional user schools are comprehensive than non-instructional user schools. Conversely, academic school type is mentioned more frequently by 'other' schools than 'all instructional' user schools. Academic and comprehensive school types together comprise the overwhelming majority of school types reported by the two school samples under consideration here. Minimal mention is made of business, vocational, technical or 'other' categories by either school sample. The percentage of 'omits' for both school samples is relatively close.

School level descriptors are considered in Table 31 for the same school samples. Again, frequency and percentages are presented for each school level category as well as the omit category. It can be seen that instructional user schools are predominantly senior high schools while 'other' schools are divided fairly evenly into the two categories of senior and combination high schools primarily. Nevertheless, the senior high school category is still mentioned most frequently for 'other' schools as well as for instructional user schools. For instructional user schools, the categories of junior and combination are used by approximately equal percentages of respondents. For 'other' schools, the junior category is least frequently mentioned. The percentage of omits for both school samples is relatively small.

Table 32 presents test performance data for these two school samples. The vast majority of both school samples report test performance equal to or above the national averages for such tests. Both school samples report small and similar percentages for the two categories of 'below average' and 'tests not used'. Again, omit percentages are comparable for the two school samples.

Table 30. Type of School

School type	All institutions		CHSLO		
	N	%	N		%
Academic	155	24.9	1121		40.5
Comprehensive	447	71.9	1601		57.9
Business	1	0.2	1		0.0
Vocational	6	1.0	1		0.0
Technical	10	1.6	17		0.6
Other	3	0.5	25		0.9
Subtotal	622		2766		
Omits	44	6.6	338		10.9
Total	666		3104		

Table 31. Level of School

School Level	All instructional		Other	
	N	%	N	%
Senior	493	74.7	1402	44.9
Junior	86	13.0	555	18.6
Combination	81	12.3	1031	34.5
Subtotal	660		2988	
Units	6	0.9	116	3.7
Total	666		3104	

Table 32. Performance on National Tests

Test performance	[illegible]		[illegible]	
	N	%	N	%
Above Average	213	37.4	579	21.6
Equal to the Average	299	52.5	1795	66.9
Below Average	39	6.8	224	8.3
Tests not used	19	3.3	85	3.2
Subtotal	570	---	2683	---
Omits	96	16.8	421	13.6
Total	666	---	3104	---

6. Previous Use of Computers

The preceding results and discussion in this report have focused on present applications of computers in secondary schools. This section will relate previous use of computers by schools surveyed. The next section will explore plans for future use among the sampled schools.

a. Initiating the use of computers

School personnel interviewed were asked to describe how they got started using computers for instructional purposes (Group E).

Teachers indicated that they had initiated interest in the uses of computers for instructional purposes in 37% of the cases. Often, they participated in data processing courses over the summer. Most of the time, these courses were NSF sponsored institutes. Other teachers took advantage of courses offered by projects which were NSF funded. Some teachers took courses at a local college or those offered by a computer manufacturer. Interest of other teachers resulted from attending a computer conference or seeing a computer installation.

After the interest was created in the teachers , they pursued a variety of avenues to obtain a computer or computer time. Efforts ranged from writing proposals for federal funding or participating in NSF funded projects,through acquiring computer time through the state or local school board or university, to obtaining donated time or equipment from a computer manufacturer or business concern. In some cases, a number of manufacturers were contacted for information about their facilities with the goal of purchasing equipment on time.

In 27% of the cases, members of the local school board or the state board of education provided the impetus, primarily by making computer time available to the schools. In a few cases, the idea to use computers originated in an educational committee. School boards also wrote proposals for federal funding. They invited teachers to a manufacturer's demonstration, aided in getting a manufacturer to donate equipment, solicited participation in a research project, and in one case, built a computer installation into a new high school. In several cases, the passage of state education bills created the positive climate for action.

For about 12% of the respondents, funding came from the federal government in some way (ESEA or NSF funded projects). In one rather unique case, the terminal was funded by the Atomic Energy Commission because the school was able to provide space for the equipment. Because of security clearance requirements, the equipment could not be located at the AEC installation.

About 12% of the responses credited the principal with originating the use of computers in their schools. In a few cases, funds were set aside to participate in a federal project or cooperative school arrangement, but they fell through, so the schools went ahead on their own. Principals coordinated their activities with the boards of education, hired teachers with computer training, sent teachers to be trained or contacted manufacturers to donate equipment.

Community influence was responsible for schools acquiring usage of computers about 6% of the time. Businesses were the predominant source. A few schools began using computers through action initiated by educational councils.

b. Former uses

Respondents to the questionnaire provided data regarding previously terminated applications of computers (Group B). Table 33 reports the number and percentage of schools indicating various types of applications which they have terminated.

Schools indicate a large number of previous uses which they have since terminated. The majority (56.8%) of all previous applications stopped by all respondents were administrative in nature. Users and nonusers differ in terms of the types of uses stopped in that users report a greater percentage of computer applications which were both administrative and instructional, and lesser percentages of those which were only administrative.

Respondents were also asked to indicate why they had stopped the computer uses. Table 34 summarizes the reasons given (Group B). The number and percentage of responses placed in each category appear in the column

Table 3.8. Subsidy by User/Nonuser Indicating Type of Application Terminated

Applications	Nonuser		User		Total	
	N	%	N	%	N	%
Unstructured	67	23.6	55	25.0	72	24.4
Administrative	68	66.7	116	53.4	184	58.6
Combined	7	9.7	47	21.4	54	18.3
Subtotal	72	---	220	---	292	---
*Delta	2677	97.2	3001	92.6	5678	92.2
Total	2569	---	3221	---	3770	---

*Delta is total case caseload minus subsidy applications terminated

Table 34. Reasons for Dropping (Number and Percent Responding to Each Category)

	#	%
1. Lack of funds or space	34	34.3
Lack of money		
Cost prohibitive		
Lack of space		
Terminated due to budget restrictions		
Funds withdrawn		
Too expensive		
Not worth cost		
2. Computer ineffective	26	27.2
Too long to correct mistake		
Inaccurate results		
Results too variant		
Late in delivery		
Some bugs		
Pupil accounting does better by hand		
Poor results in scheduling		
Poor communication and late delivery		
Inadequate computer for needs		
Difficult to operate and maintain		
3. General dissatisfaction	10	10.4
Too much trouble		
Didn't like		
Incompatible with existing programs		
Too much work and too many problems		
Loss of control		
4. Experimental projects	7	7.3
Had computer for only 1 month, 3 weeks, etc.		
Experimental program - no money to continue		
5. Lack of qualified instructors or DP staff	7	7.3
No more qualified instructors left at school		
Lack of knowledge		
Difficulty getting operator and knowledge personnel		
Inadequate staff		
6. Miscellaneous	5	5.2
City unified all computer work under city's jurisdiction		
Two computers stolen-not replaced this year		
Poor attendance		

Table 24 Continued

		N	%
6.	Miscellaneous (continued)		
	Converted to another system No response		
7.	Service	6	6.3
	Administration was not satisfied with the service Service could not meet all desired requirements Service discontinued by supplier Administration was stopped because service was not reliable		
8.	Inaccessibility of computer	6	6.3
	Too far away Access to computer was too slow for instructional uses		
9.	Characteristics of school	3	3.2
	School was large enough Unable to work into school schedule due to size and nature of school No current applications for computer usage		
10.	Overload on someone else's computer	3	3.2
	Junior college can no longer handle work load Service center computers were unable to schedule the school		
	Total	93	

to the right of the title for each category. Within each category are listed typical responses.

The most frequently mentioned reasons (36.5%) are concerned with lack of funding or space (which is probably also lack of funding). It appears that funds were lacking for the computer use for various reasons. Either the school had fiscal restrictions which no longer permitted the expense of computer use or it had been decided that the computer was not worth the cost. In many cases, the abandonment of computer use because of lack of funding may occur for both reasons. The school realized that the budget had to be cut and the computer use was not considered cost-effective enough to be continued.

A fair proportion (17.2%) of the schools responding indicated that the computer was ineffective in the work performed. These schools indicated that the computer was either unreliable, inaccurate, too slow, produced no real improvement, was generally inadequate, or too difficult to operate. A computer devotee might indicate that many of these problems probably involve human failings; this may be true. But it is interesting to note that the computer was at the center of the blame for the failure of these applications.

Just under 11% were generally dissatisfied, indicating that the computer use was too much work, incompatible, too problem-plagued and took control over operations away from administrators.

The next most frequently mentioned reason (7.5%) is not actually a negative reaction to the computer. These schools simply had experimental programs which ran out and could not be continued for one reason or another.

Other schools (7.5%) gave up computers because of lack of qualified personnel.

Other reasons included: inaccessibility of the computer, poor service, and abandonment by an outside source.

7. Plans for Future Use

The RESULTS AND DISCUSSION section concludes with a short exploration of where secondary schools intend to go with computer applications.

During interviews, teachers (Group E) indicated that their applications were relatively permanent. About 40% said they were permanent with no qualifications. Those who were not absolutely certain about continuance of their computer use, attributed their doubts to the uncertainity of funding. Although most were confident of continued funding, they faced the reality that school budgeting is a year-to-year proposition and that one can never be sure that funding will continue. In this regard, several teachers mentioned that local funding was more secure than federal funding. They indicated that federal funding is necessary to launch computer projects and get them accepted by local school funding agencies. After that point, continued funding is more assured through local than through federal sources.

About one quarter of the interviewees stated that instructional computer use was a permanent feature of the schools' program. Almost all predicted that all or some of their applications would expand and new applications would be added. A few also felt that some of their present applications might be dropped. Only small numbers, about 10%, believed that their present application would be dropped during the following school year.

Questionnaire recipients were asked to indicate whether they planned to initiate new applications during the next year and if so, the type of applications that they planned (Group B). Table 35 summarizes their responses by respondent category.

Of all respondents, 25.3% intend to initiate one or more new applications. The largest percentage of these (44.2%) anticipate new applications in both administrative and instructional areas. A much larger percentage of users (50.0%) than nonusers (13.1%) intend to start new applications. The largest percentage of users (44.8%) and nonusers (43.0%) alike state that they will initiate both administrative and instructional applications. However, users place more emphasis on new instructional applications and less emphasis on new administrative applications than do nonusers.

Those schools in the three user categories tend to indicate further expansion of the same type of applications. That is, the largest proportion of instructional only users (58.6%) intends to initiate instructional only

Table 35. Schools Indicating Type of Use by Respondent Category of Intended Application if Any

Type of Application Intended	Respondent Type: Nonusers N	%	Instruc. Only N	%	Admin. Only N	%	Both N	%	All Instruc. N	%	All Admin. N	%	All Users N	%	Total N	%
Admin. only	116	34.6	4	3.6	115	48.9	32	11.8	36	9.4	147	29.0	151	24.4	267	28.0
Instruc. only	75	22.4	65	58.6	43	18.3	82	30.1	147	38.4	125	24.6	190	30.7	265	27.8
Combined	144	43.0	42	37.8	77	32.8	158	58.1	200	52.2	235	46.4	277	44.8	421	44.2
Total intending new applications	335	13.1	111	56.9	235	42.3	272	57.7	383	57.5	507	49.4	618	50.6	953	25.3
No new applications intended	2214	86.9	84	43.1	320	57.6	199	42.2	283	42.5	519	50.6	603	49.4	2817	74.7
Total	2549		195		555		471		666		1026		1221		3770	

applications, 48.9% of administrative only users anticipate starting only administrative applications and 58.1% of both users indicate an intention of beginning both instructional and administrative applications.

Interviewees were asked to dream about what they would want in computer applications if there were no cost restrictions (Group E). Most of the interviewees indicated they would like to have their own in-house computer system. Others wished for a more modern system than they were presently using. Many would like to add auxiliary equipment, everything from discs, tape drives, CRT's, closed circuit TV, to teletypes, keypunches, etc.. Many teachers indicated that the one thing they needed most was a keypunch and if they got that they would be set. It is interesting that the lack of something as minor and inexpensive as a keypunch is standing in the way of these schools accomplishing their instructional computer goals.

The second most common response centered around the desire to expand the present program. Changes which were indicated ranged from the addition of one course to the use of computers in all courses in the school.

Teachers at most schools indicated during interviews that they had actually made plans for implementation of new applications. Of these, about two-thirds plan to implement new programs in the Fall of 1970, about one-sixth sometime during the next five years and the remainder during their 1970 summer programs. Other schools had only tentative plans.

The next logical question is "Where do these schools anticipate receiving support?" Table 36 indicates the number and percentages of schools intending to initiate a new application which anticipate seeking support from the sources listed.

It is obvious that schools anticipate turning to local sources for funding to a great degree. Again, it is possible that these local sources will in turn seek support from government agencies or private foundations.

a. Problem areas

The problems which schools are having with present computer applications provide insight into some of the directions these schools will be taking

Table 36. Anticipated Sources of Support for Planned Application

Source	Schools N	Schools %
USOE	63	6.6
NSF	39	4.1
Other federal agencies	61	6.4
Private foundations	37	3.9
State	245	25.7
Local	719	75.4
Total schools intending to initiate new applications	953	*.....

*Total is more than 100% because some schools anticipate seeking support from more than one source.

in order to solve their problems.

The problem most frequently mentioned by interviewees (Group E) dealt with equipment and normally centered around insufficient access to equipment, insufficient computer time available, or limited equipment. Remoteness of equipment causes transportation problems and slow turn-around time. Other problems with the equipment concerned noise generated from the computer, time lost in repair, and expense of the computer or terminal.

Personnel was another source of problems. More teacher training is needed. Oftentimes, students become more proficient than their teachers. This can happen because the teacher does not have enough time to keep up with his own programming skills.

Over-involvement of students was cited by many as being a problem or potential problem. Some students get extremely involved and neglect their other classes. This causes friction with other teachers and makes it even more difficult to convince them that the computer should be integrated into their curriculum. Another source of friction occurs between the math and business teachers. Each believes the computer's proper place should be in his department.

The interest shown by students can also be viewed as positive. Helping students to receive the fullest benefit from their experience presents a challenge to teachers. Many teachers may feel uncomfortable with this challenge. Teachers' main problems concern the effort and energy required to teach computer programming and the lack of time. They point to the extreme lack of quality texts geared for the high school student and the tedious aspect of teaching error analysis. Some teachers are concerned that the math courses are turning into computer classes. They believe the computer should play a subordinate role in the curriculum.

There are some problems that are nearly impossible to solve. Curbing student involvement might be one of these. No one is going to stop a student from pursuing his interest. Money problems probably will not disappear and teachers will have to work with what they have until more money is found.

b. User needs

The largest number of respondents were very satisfied with their computer applications. Others were satisfied but pointed to changes they would like to see, e.g., expansion and improvement of their courses, better texts, etc. A small percentage were not satisfied with their applications. They listed equipment wants, frustration in expanding the program and limited effectiveness as reasons for discontent. Respondents expressed the desire to have more students involved in using the computer as well as making access time overall as long as possible. Also, in order to expand, it is necessary to get more teachers interested in using the computer.

The remaining responses cover a variety of wants. They include: an independent non-school-paid evaluator, computers serving some library functions (e.g., encyclopedia type references), a grant to study EDP needs state-wide and research on EDP needs in industry.

The firm plans of these schools were pretty much of the same nature as their dreams, only more modest in most areas. Expansion in a variety of ways was the most frequently mentioned response. These ways included adding: new courses, new applications (frequently CAI or management of instruction), new departments to those already participating (normally science), more students, new equipment and more training for teachers.

The two most common needs expressed for continuation or expansion of computer applications are money and equipment. This accounts for over 50% of those responding to this question.

Personnel training was another important need as was program development and materials. Other schools mentioned lack of space, need for additional time to devote to the program, reduction of administrative opposition, etc.. The majority of teachers felt that their training was adequate, but only for their existing applications. Some respondents felt that while their own training was adequate, other teachers involved did not have enough background and training. Those who felt that their training was not adequate enough for plans they had for the future, desired training in the following: other computer languages, more advanced programming, participation in

courses tailor-made for teaching at the high school level. They also expressed a great interest in obtaining more hands-on experience. Several teachers mentioned the desirability of summer institutes. Others wanted to visit industries to see what is going on so they can advise students vocationally.

Respondents felt that there were many ways in which outside sources could help them. Money was the most typical response offered. Many respondents were concerned with information acquisition. Information about curriculum development and what other schools were doing with computers was most wanted. One suggestion was a curriculum program library where programs would be available to anyone expressing interest in them. Several suggestions were made as to how the community and businesses in the area could help. Commonly mentioned was the desire to see different computer applications in operation and the opportunity to work on computers in the community and local industry.

Other suggestions were made for sponsoring research on the value of the computer in the classroom and the establishment of an independent agency to make information available on ways of using the computer for various purposes.

CONCLUSIONS

Extent of Administrative and Instructional Applications

From the 12,306 responses received from the 23,033 secondary schools in the continental United States, it can be concluded that more schools are not using computers than are. The ratio of nonusers to users is roughly 2 to 1. Among those schools that are using computers, administrative applications dominate. This domination of administrative over instructional use is of an approximate 2 1/2 to 1 ratio. Although no other survey of this nature and scope has ever been performed, some previous studies provide a rough estimate of instructional use of computers in secondary schools. Comparison of the present survey with these earlier studies indicates that instructional use of computers is growing rapidly in the secondary schools in the United States. In order to chart this growth, future surveys are necessary to provide additional data points. A set of computer use indicators,similar to the economic indicators used by government,might be developed to chart computer use. Educational planners at all levels would find such information quite useful.

Degree of Administrative and Instructional Use Among Computer Users

Although the number of schools using computers is still in the minority, the degree of computer use in these schools is quite high. There is, of course, wide variation in the degree of use among these schools. However, indicants, such as number of computers used, number of applications, number of students involved, amount of computer time used, and frequency of use show a fairly high degree of computer use.

Nature and Purpose of Instructional Use

At the same time, the diversity of applications and subject areas in which computers are being used instructionally is not at the same high level on the average. Problem solving and EDP skills training applications dominate instructional use of computers in secondary schools. EDP skills training is of two types. Some EDP skills training is provided to students in preparation for entering a career in the computer field. More frequently,

EDP skills training is provided to students in conjunction with the use of a computer in problem solving applications. Problem solving and EDP skills training form the core of classroom instructional uses. Occuring somewhat less frequently are CAI and gaming and simulation applications.

The other core of computer use centers on guidance and administration applications. Management of instruction applications occur less frequently in conjunction with these core applications.

The dominance of computer applications by the mathematics curriculum is even more marked than that of problem solving and EDP skills training. In most of the schools surveyed, computer applications have been well integrated into the mathematics curriculum. However, applications have very rarely spread to other subject matter areas to any extent.

Most typically, instructional use of computers starts with mathematics departments in the schools. If use does spread to other departments it is normally through the efforts of mathematics teachers. Why computer use has not spread more rapidly is very difficult to determine. Mathematics teachers indicated that they have met with considerable resistance when attempting to encourage colleagues in other departments to develop computer applications. It is evident that the computer quite readily lends itself to use in the mathematics courses. On the other hand, applications in areas such as social studies, English, etc., are less obvious, and probably require considerable imagination and interest on the part of teachers in these subject areas.

It is known that the computer can be threatening from the standpoint that students frequently learn more about it than teachers do. Therefore, a teacher undertaking a computer application must have sufficient confidence in himself not to be bothered by such an occurrence. Possibly, training programs designed to encourage computer use among teachers in subject areas other than mathematics, as well as among mathematics teachers might help break down some of the resistance to the spread of computer use.

At least one other factor which stands in the way of computers being used more throughout the entire curriculum is concerned with the structure and content of the curriculum. The curricula of most schools, as presently

constituted, make it difficult to introduce innovations. In many schools, the schedule is already packed with traditionally required courses, particularly for college bound students. Several teachers stated the need for modular curriculum scheduling. This approach divides the school day into smaller time periods than the common 50 minute class sessions presently used in most schools. With these additional units of time, the curriculum planners have more flexibility to introduce curriculum innovations. A number of computer users have gone to modular scheduling quite successfully. Providing short so-called mini courses or introducing modular scheduling permits the inclusion of computer uses in their tight schedules. It may be concluded that merely introducing computers into a school does not automatically cause innovation to take place. Many schools, in fact, may be realizing less than full benefit from instructional computer use because of the structure of the class schedules.

It is safe to conclude that the computer is more frequently used as a tool in instruction rather than as the object of instruction. Therefore, the purposes of the computer applications tend to concern themselves with the subject matter such as mathematics, science, and economics. The computer simply aids the student in accomplishing the content goals of the subject area. Another way of describing the nature of computer applications is to describe what students actually do in these applications. Most typically, students write and run programs on computers, using it as a tool to accomplish the goals of the course they are taking.

A number of interesting controversies surround the instructional use of computers in secondary schools. One of these deals with the mode of use of the computer. At one end of the continuum is the mode in which the computer is used in the classroom on a highly formalized basis. At the other end of the continuum appears the use of the computer in a laboratory setting in a very informal way. In the former mode, the use of the computer is normally planned by teachers and scheduled for use on homework and classroom assignments. When used more informally, the computer is simply made available to students. They are instructed how to use the computer if and when they come to the laboratory to use it. In this way, students may use the computer in a variety of classes as they feel they have a need to use it.

In this latter mode of operation, it is the students,rather than the teachers,who spread the use of the computer into various subject areas. Schools and individual applications may fall at various points along tvis continuum. Which mode of use is most effective for which educational settings and objectives is a question worthy of investigation.

Another controversy concerns the necessity of actually having a computer present in the school. Some schools actually do have a computer in the school, others use the computer through a terminal or take their computer programs to an off-site location to be run. Still other schools use both on-site and off-site computers. Some teachers feel that it is important that the computer be present in the schools so that students can actually see the computer and interact with it on a direct hands-on basis. Others feel that this is not as critical as having access to a large scale, sophisticated computer which is probably too expensive to actually have on-site in the school.

Many schools have introduced the use of a mini computer, which normally is a small scale inexpensive machine which can be used in the school. The controversy here centers around the instructional merits of the small scale computer versus the large scale computer discussed in the context of cost-effectiveness. Regarding this controversy, it was interesting to note that one can not judge the sophistication and educational significance of a school's computer use simply on the basis of the sophistication of the computer being used. A more important factor determining the quality of the instructional application is the expertise and imagination of the teachers involved in the application. This is not to say that more sophisticated computers in the hands of competent and motivated teachers will not improve the quality of instructional applications. However, good teachers can produce good instructional applications without the use of sophisticated computer equipment. Conversely, access to sophisticated computers will not result in effective instructional applications unless used by competent and motivated teachers.

One additional, particularly interesting controversy centers around the type of computer languages which students should be taught. At one end of the continuum are those who believe that students should be taught

assembly language. At the other end are those who feel students should be taught compiler language. The reason set forth by most assembly language proponents suggests that students learn about the logical operation of the computer more thoroughly when using an assembly language. On the other hand, advocates of the compiler language indicate that understanding the logic of the computer is less important than understanding the logic of programming evident in compiler languages. Assembly languages are used most frequently by teachers who wish students to learn about the computer itself, i.e., EDP skills training for vocational purposes. Compiler languages are frequently taught to students who will use programming in the solution of problems. Teachers of compiler languages can teach the essentials of such a language fairly quickly. This permits them to turn to what they consider to be the most important aspect of the computer use, that is, actually using it for the solution of problems. Each approach seems appropriate when used in the way described here.

One of the greatest benefits derived from the use of computers in instruction results from its capacity to motivate students. Why the computer is so effective in motivating students is not easy to answer. This question provides an excellent area for further research. Some have suggested that it is the hands-on experience that computers provide. Others suggested that it could be that computers make the subject relevant. This may be particularly true of mathematics. Whatever the reason, investigation into this area should prove fruitful for continuing to improve computer based instruction, as well as instruction which is not computer-oriented.

In general, it appears that computers have not been introduced into the school curriculum after a careful and systematic evaluation of the instructional needs within schools. As indicated before, someone in the mathematics department frequently initiates the use of computers. If the use spreads, it does so in a relatively unplanned manner. Introduction and spread of computers in this fashion has resulted in a large number of worthwhile computer applications. However, there still is a need for the development of a means of systematically determining educational needs and objectives and applying computers where they can be most effective. As

part of the systematic application of computers in the instructional process. There is a need for evaluating the effectiveness of computers. Based on such an evaluation, computer applications can then be revised and improved.

Level and Source of Support of Instructional Use

Information regarding the level and source of support of instructional computer applications indicates that even within the sample of schools which are using computers for instructional purposes, only a minute percentage of the educational dollar is being spent on instructional applications. The overwhelming bulk of the money being spent comes from local sources. There are also a variety of cooperative arrangements which have been developed for the sharing of computers and information about computer applications. Many schools see the need for developing these types of cooperative arrangements, although there is some difference of opinion as to whether these cooperative arrangements should involve sharing of computer facilities. There are some schools that prefer to have sole access to a computer rather than share one.

Previous Use

Possibly the most revealing finding regarding previous use of computers concerns itself with how instructional applications develop. Many have been of the opinion that instructional applications have developed as a way of getting more use out of a computer which is already being used for administrative purposes. Information from the schools surveyed indicated that this is probably not the case. Most instructional applications have developed independently of administrative applications within the schools.

Future Use

Regarding future use, schools tend to show preference for extending present applications further rather than initiating new types of applications. In addition, they report the intention of continuing to turn to local sources for the bulk of their support in the future. To some degree, this may be due to the lack of knowledge as to where one can obtain funds for computer applications. Information regarding source of funds might prove useful. Teachers may be inclined to continue their present applications because they indicate that they are generally satisfied with the

applications that they have. They do,however, point out that there are problems and that they have certain needs which should be filled to enable them to continue to expand instructional use of computers. These needs most frequently concern funding, space, and training, in addition to a need for information. Money, of course, is normally the largest problem. However, project staff were impressed by the fact that many teachers indicated that fairly minor needs stand in their way of gaining full advantage from their computer use. For instance, many are blocked by the need for an additional keypunch. This suggests that, quite possibly, a small expenditure of funds could significantly improve the computer use of a fairly large number of schools. In these instances,there is a need for funds to be made available in small amounts.

One problem which schools have with their computer applications results, in part, from solutions to these problems. Frequently teachers who receive training in the use of computers will leave the educational community to take jobs in industry where they can be rewarded more handsomely. Such an occurrence only makes the need for trained teachers more severe. Teachers must be rewarded more for developing and implementing computer use in order to keep them employed in the schools.

With the heavy emphasis on teaching programming, one specific problem takes on considerable importance. Several teachers mentioned the inadequacy of diagnostics produced by compilers and assemblers. Present program diagnostics are geared toward the operational programmer rather than the student. There seems to be a need for program diagnostics which are more instructional in nature. Some efforts along these lines have been made, but more must be done.

Teachers mentioned that some students get so involved with computers that they neglect their other courses. This causes tensions and jealousies among departments within the schools and frequently has considerable effect on the students' overall academic performance. It must be recognized that the computer is a tool which is designed to aid instruction, not control it. At the same time, computers present a challenge to students and teachers alike. Teachers must meet the challenge to continue to guide

students learning. If they fail to meet the challenge, students will learn unguided and thus possibly ineffectively.

The use of computers for instructional purposes appears to be growing rapidly. However, if it is to continue to grow and we are to continue to derive the fullest benefit from its unique capabilities, its introduction and use in the instructional process must be carefully and systematically planned. Also, much more must be done so that schools can share information about the problems and promises of computers. Finally, the effectiveness of computer applications must be evaluated to derive the fullest benefit from every educational dollar spent on them.

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APPENDIX I

Survey Instruments

I-A. Letter accompanying first and second questionnaire mailings

I-B. Questionnaire (instructions and answer sheet)

I-C. Postal card

I-D. Interview questions

I-C. Letter accompanying first questionnaire mailing

AMERICAN INSTITUTES FOR RESEARCH
WASHINGTON OFFICES

Address: 8555 Sixteenth Street, Silver Spring, Maryland 20910
Telephone: (301) 587-8202

January 20, 1970

Dear Principal:

The expanding use of computers in secondary education is a subject of great interest to both the National Science Foundation and the Office of Education. Both agencies need more current and factual information on which to base planning and policy decisions in this area. Accordingly, the Office of Computing Activities of the National Science Foundation is sponsoring a nation-wide survey to learn more about the nature and extent of computer usage in American secondary schools.

The American Institutes for Research, which is conducting this survey, invites you to participate by completing the enclosed questionnaire. All data collected will be aggregated for analysis and reporting purposes and no comparisons between schools will be made.

While the questionnaire deals with both administrative and instructional uses of computers, the emphasis is on instructional uses. The first part of the questionnaire defines the types of computer usage included in this survey and outlines the information requested. After reading this first part and subsequent questions, you may want to assign sections of the questionnaire to different members of your staff who are most knowledgeable about the particular computer applications in your school. If this is the case, please designate one individual to coordinate the completion of the questionnaire and to be responsible for the return of the answer sheet.

Thank you for your help in assembling this much-needed information. A report of the survey findings will be made available to you.

Sincerely,

George N. Johnson

George N. Johnson, Ph. D.
Director
Institute for Communication Research

GNJ:fo
Enclosures

Corporate Office • 135 W. Butterfield Avenue, Pittsburgh, Pennsylvania 15213 • (412) 881-7566

J-0. Letter accompanying second [illegible]

AMERICAN INSTITUTES FOR RESEARCH
WASHINGTON OFFICE

Address: 8555 Sixteenth Street, Silver Spring, Maryland 20910
Telephone: (301) 587-8200

23 February 1970

EVEN IF YOU DO NOT USE COMPUTERS, PLEASE READ THIS LETTER

Dear Principal:

Can you agree on a few instances of great ideas to help find out what is happening with computers in secondary schools?

Recently, as part of a study sponsored by the National Science Foundation, we sent every secondary school principal in the country a questionnaire concerning computer applications in his school. If you have already returned that questionnaire, do not re-spend again. Thank you for your participation.

If you have not returned the questionnaire, we urge you to take the time to provide the information requested. Our early returns indicate that many principals thought that we wanted returns only from computer users. On the contrary, we need returns from non-users, as well as users, in order to measure the true level of computer use in American schools. If your school does not use a computer in any way, less than 5 minutes is required to provide the general information about your school requested in Section A. If your school is using computers, please complete all applicable sections. The questionnaire must be received by us promptly to permit adequate time for the preparation of the report of survey findings.

Unlike many such surveys in which you have participated, a report of this survey will be made available to all schools which respond. The report will give details concerning the nature and location of computer use in high schools throughout the country. In addition, both the National Science Foundation and the Office of Education want this information to support planning and policy decisions. We feel these decisions will have considerable effect on future use of computers in secondary schools.

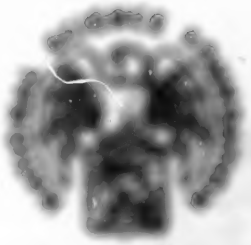
Thank you for helping us assemble this much needed information.

Sincerely,

Arthur L. Kornhauser

Arthur L. Kornhauser, Ph. D.
Assistant Director
Washington Office

A.L.K./kpf



A SURVEY OF COMPUTING ACTIVITIES IN SECONDARY SCHOOLS

This survey is being conducted by the American Institutes for Research under the sponsorship of the Office of Computing Activities, National Science Foundation. Our objective is to obtain accurate information about the nature and extent of computer usage in American secondary schools. We feel this can best be accomplished by securing information directly from the schools. Your cooperation is very much appreciated.

DEFINITION OF COMPUTER USAGE

In order that all respondents may have the same frame of reference in answering the questionnaire, we want to discuss "computer usage" as it is defined for the purpose of this study. Hopefully, it will help you in completing the questionnaire and will assure uniform reporting of information.

What is a Computer?

For the purpose of this study, the machines utilized in computer use general process computers which operate under the control of a stored program. They usually include the central processing unit, auxiliary storage, communication links and all peripheral equipment. They are capable of performing more than certain mathematical computations on the unit problem of their operation. The programmable unit we are interested in is the computer only when it is operated with a stored program. Electronic accounting machines are specifically excluded in this definition.

Instructional and Administrative Applications

Use of the computer as a tool in the instructional process is the primary focus of this study. This term encompasses all applications and problems in classroom and laboratory instruction, as well as instructional management problems and scheduling. The term is commonly concerned with the school's use of computers for administrative or management purposes, i.e., for pupil accounting, business accounting, research, development and planning. Specific applications, both instructional and administrative, are described in Section B.

Access to the Computer

To be included in this survey, it is not necessary that a computer application involve a computer which is located in the school. We are concerned with the use of computers in any or all of the following ways:

Dial-Access Access — Consumer physically present in school or school system, either owned or leased.

Remote Access — Terminal in school connecting with computer at any location (e.g., a network of schools or state-owned systems).

Periodic Access — Computer located close enough to school that runs can be made to use the computer.

Funding

Schools should report in this survey only those computer applications where the school or school system is responsible for some portion of the cost of the application. That is, some part of the cost of the computing time must come from the operating budget of the school or school system, regardless of the source of the support and nature of the investment. The investment for hardware might take the form of staff time devoted to the development, and so long as the cost of that staff time is part of the operating budget.

GENERAL INSTRUCTIONS

The questionnaire is divided into four sections:

Section A, General Information About Your School, should be completed by all respondents whether or not they are involved in the use of computers as defined above.

Section B, Checklist of Specific Computer Applications, asks you to indicate which applications your school has.

Section C, Budget and Computer Hardware, contains two charts on which you provide information about your school's budget and the computers your school is using.

Section D, Instructional Applications, asks you to provide information on each instructional application of computers in the school.

Then, if your school has no computers (even outside the definition given above) you complete only Section A. If your school is using computers for administrative purposes only, you complete Sections A, B, and C. If your school has one or more instructional applications of computers, you complete all four sections.

Please note that there is an answer sheet with numbered rows and boxes corresponding to the questions in each section. Mark "X" if a question is not applicable to your school or its use of computers, or if the information is not obtainable.

If you have any questions, please call:

Mr. Charles Darby, Jr.
(301) 397-4243

SECTION A

General Information About Your School

(To be completed by all respondents)

A.1 In the space provided on the answer sheet, please print the name of the individual who can be contacted regarding the contents of this questionnaire.

A.2 Please give the complete office telephone number, including area code, of the individual in item A.1.

A.3 Please give the name and complete address of the school receiving this questionnaire.

A.4 What grade levels are included in your school?

A.5 What type of school is it? Check the response in each column which is most appropriate.

A.6 What is the current enrollment in your school?

A.7 How many full-time teachers are on your staff this school year, not counting counselors and administrators (principal, etc.)? (Include full-time equivalents of part-time teachers in the appropriate whole numbers.)

A.8 If you offer a high school diploma, what percentages of students in last year's graduating class went on to college, to junior college, and to technical school?

A.9 Check the statement which best describes your student/class performance on standardized aptitude or achievement tests.

Please keep in mind in answering the following questions, the definition of "computer usage" given at the beginning of this questionnaire.

A.10 How many members of your teaching staff have had formalized training in the use of computers?

A.11 Check the type(s) of organizations which have conducted or sponsored this training.

A.12 Do you have a center or locus of responsibility for coordinating computing activities in your school?

A.13 If your school previously used a computer but has stopped, please state why and indicate nature of use.

A.14 Does your school intend to initiate a new computer application within the next two years?

A.15 If "YES", is the purpose of this planned application administrative, instructional or both?

A.16 Check the anticipated source(s) of support for this application.

A.17 Is a computer being used by your school at this time for any instructional or administrative purpose?

If you answered "YES" to Question A.17, please go on to the next section.

If you answered "NO" to Question A.17, you have given us all the requested information about your school. Please fold the answer sheet and mail it to us. Directions for mailing are printed on the back of the answer sheet. Thank you very much for your cooperation.

SECTION B

Checklist of Specific Computer Applications

This section describes specific instructional and administrative applications of computers in secondary schools. Please indicate in Section B of the answer sheet whether or not your school is involved in each application within the limits of the definitions given earlier. Simply check "YES" or "NO" after each number corresponding to the numbers below.

Applications B-1 through B-4 refer to classroom and laboratory learning situations where the computer is involved in the instruction of students.

B-1 Computer-assisted instruction, including drill and practice, tutorial and dialogue modes using programmed instructional techniques.

B-2 Computer used as a computational aid to problem solving in classes and laboratories for science, mathematics, accounting, economics, etc.

B-3 Teaching electronic data processing skills to students, including the preparation of input, machine operation, programming and systems analysis skills. The instruction must include the running of a program on a computer.

B-4 Testing and simulation of real life situations using a computer.

B-5 Computer-assisted instruction involving TV, film, etc., including the use of the computer to control the presentation of media in the classroom or other learning situation, or to analyze audio-media classroom interaction.

B-6 Any other classroom or laboratory learning applications not covered above in B-1 through B-5.

Applications B-7 through B-9 deal with the management of instruction, guidance, and counseling, where, for the most part, the computer is involved indirectly in the instructional process by providing information to teachers and counselors.

B-7 **Management of instruction, including individual instructional diagnosis through the analysis on a computer of student learning needs and progress and the prescription of individual instruction.**

B-8 Guidance and counseling, including academic guidance, occupational counseling, and personal adjustment counseling. A computer might be used to store and analyze, or retrieve information concerning such assessment measures as ability and achievement tests, personality profiles, occupational interest data, etc. (Where test scoring and analysis is performed by a commercial test publisher, it should not be reported here as a computer application to your school.)

B-9 Any other application of computers for instructional management, guidance and counseling.

Application B-10 includes all administrative applications of computers. If your school has any of these applications, check "YES" after B-10.

B-10 Administrative applications:

Student accounting — to arrange student schedules, to keep student records, such as educational history, attendance, grades, or to prepare report cards, etc.

Resource management — to schedule transportation, classrooms, etc., to maintain personnel and financial records, or to allocate materials.

Planning — to plan for future resource allocation by projection of enrollment, cross-tabbing, educational system simulation, etc.

Research and Evaluation — to study and evaluate teaching methods, the learning process, curriculum, instructional materials, etc.

Any other administrative applications.

SECTION C

Budget and Computer Hardware

In this section you are asked to provide information about your school budget and the computers which your school is using for the applications described in SECTION B.

C-1 *In the cells provided in the table on the answer sheet, please enter an estimate of your school's Total Annual Operating Budget and its Total Annual Budget for Instructional Applications of Computers. Then in Column 1 estimate the percentage of the Total Annual Operating Budget contributed by each source shown. Do the same in Column 2 for the Total Annual Budget for Instructional Applications of Computers.*

C-2 A table is provided for this item on the answer sheet. For each computer and terminal, list manufacturer and model in Column 3 and place a check mark under the appropriate terms in Columns 4-7.

If your school is using a computer for instructional purposes, i.e., if you answered "YES" to any one of items B-1 through B-9, please go on to the next section.

If your school has no instructional applications of computers, you have given us all the requested information about your school. Please fold the answer sheet as directed and mail it to us. Thank you very much for your cooperation.

SECTION D
Instructional Applications

In this section we are requesting details regarding each instructional application of computers in your school. For example, if you checked "YES" to item items in D-1 through D-6, you should provide information for each of the items applications checked. Note that the answer sheet provides space for up to four sets of answers. If you checked more than four instructional applications, please reproduce Section D of the answer sheet or use a plain sheet of paper numbered appropriately to record answers for additional applications.

You may wish consider each of the items D-1 through D-6 as a single application. For example, if you have checked item D-1, computer-assisted instruction, and CAI is used in both mathematics and chemistry classes in your school, this is one application. Give a combined figure representing both mathematics and chemistry when providing answers to questions regarding the number of students involved, etc.

If you find a question that is clearly not relevant to a particular application or if the information is not available, indicate this by writing "0" in the answer space. Answer the following for each instructional application checked. Ask please do not use "0" if a meaningful response is possible.

D-1 Copy the code number for one instructional application which you checked in SECTION B. Give the purpose of this application. Describe briefly what the student does in this application. (Does he write and run programs, work at a terminal, use a computer, etc.)?

D-2 Copy the code number for this application again in the blank provided at the top of the chart.

D-3 List all subject areas which are involved in this application (e.g., English, chemistry, mathematics, data processing, etc.)

D-4 Estimate how many students are participating in or are directly affected by this application. (Participation include such tasks as writing a program, working at a terminal, receiving instruction in computers, etc.)

D-5 Estimate how many teachers are participating in or are directly affected by this application. (Writing software, lecturing, running a program, etc.)

D-6 Estimate how many hours of participation per student are involved per month.

D-7 Of the number of hours per student which you estimated in question D-6, estimate the average number of hours of actual computer use (running a program, working at a terminal, operating a computer, etc.) per student.

D-8 Estimate how many hours of participation per teacher are involved per month. (Include all of the time the teacher spends, preparation time, etc.)

D-9 Of the number of hours per teacher which you estimated in Question D-8, estimate the average number of hours of actual computer use per teacher (running a program, working at a terminal, operating the computer, etc.)

D-10 For this application, how many total hours of computer time per month are available? (If time on more than one computer is available, indicate the number of hours available for all computers combined.)

D-11 For this application, estimate the number of hours of actual computer running time per month. (Include programming testing time, debugging time, etc., as well as time during which student and teacher are using a computer. If more than one computer is used, indicate the combined total number of hours of actual computer running time for all computers.)

D-12 Of the time you gave in item D-11, what percent is actual central processing unit time?

D-13 At what grade level is this application introduced?

D-14 Who prepare software (programs, system documentation, instructional material) for this application?

D-15 Which computer programming language(s) is/are used for this application?

D-16 List the sources of support for this application and the amount of support from each source. (Be as specific as possible, but use generic names for the sources of support, such as ESEA Title III, ESP Grant, etc. Do not use local titles or project names.)

When the questions above have been answered for each instructional application of computers in your school, please fold the answer sheet and mail it to us. If you have an additional answer sheet fold it inside. Directions for mailing are printed on the back of the answer sheet.

The American Institutes for Research and the National Science Foundation wish to thank you for your cooperation in providing this information. As indicated in the cover letter, a copy of the report of this survey will be made available to your institution. We hope you will find it useful.

If you have any additional information on your school's use of computers which you think we should have, please send it to us in a separate envelope.

ANSWER SHEET

The blanks and boxes provided for answers are numbered in accordance with the numbers in the **Questionnaire Booklet**

SECTION A
GENERAL INFORMATION ABOUT YOUR SCHOOL

A-1 Individual Contact _____

A-2 Telephone Number _____
(area code)

A-3 School _____

Address _____

_____
(zip code)

A-4 Grades _____ thru _____

A-5 School Type
(1) ☐ Academic
(2) ☐ Comprehensive
(3) ☐ Business
(4) ☐ Technical
(5) ☐ Vocational
(6) ☐ Other, specify _____
(7) ☐ Senior
(8) ☐ Junior

A-6 Enrollment _____

A-7 Teachers _____

A-8 College _____% ☐ N/A

Junior College _____%

Technical School _____%

A-9 Test Performance
(1) ☐ Above national norm (51st percentile or higher)
(2) ☐ About equal to national norm (40-60th percentile)
(3) ☐ Below national norm (39th percentile or lower)
(4) ☐ Tests not used

A-10 Teaching staff computer training _____

A-11 Training Conducted or Sponsored

Conducted	Sponsored	
☐	☐	N/A
☐	☐	Technical or Computer School
☐	☐	College or University
☐	☐	Computer Manufacturer or other Source
	☐	National Science Foundation
	☐	U.S. Office of Education
	☐	Other Federal Agency, Specify _____
☐	☐	Other, Specify _____

A-12 Center of responsibility ☐ Yes ☐ No

A-13 Why stopped _____

_____

Nature of use
(1) ☐ instructional
(2) ☐ administrative
(3) ☐ both
(4) ☐ N/A

A-14 Initial application ☐ Yes ☐ No

A-15 Purpose
(1) ☐ Administrative
(2) ☐ Instructional
(3) ☐ Both
(4) ☐ N/A

A-16 Anticipated Sources
☐ N/A
☐ U.S. Office of Education
☐ National Science Foundation
☐ Other Federal Agencies
☐ Private Foundation
☐ State
☐ Local

A-17 Use of Computer ☐ Yes ☐ No

SECTION B
CHECKLIST OF SPECIFIC COMPUTER APPLICATIONS

	Instructional	Yes	No
CMI	B-1	☐	☐
Problem Solving	B-2	☐	☐
EDP Skills	B-3	☐	☐
Gaming/ Simulation	B-4	☐	☐
Medicated Instruction	B-5	☐	☐
Other, Specify _____			
_____	B-6	☐	☐
Management of Instruction	B-7	☐	☐
Guidance	B-8	☐	☐
Other, Specify _____			
_____	B-9	☐	☐
	Administrative		
	B-10	☐	☐

[illegible]

[illegible]

Sources	Total Annual Operating Budget for School S_____ Col. 1 Percent of Total Annual Operating Budget Contributed by Each Source	Total Annual Budget for Instructional Applications of Computers S_____ Col. 2 Percent of Total Annual Budget for Instructional Applications of Computers Contributed by Each Source
[illegible]	_____ %	_____ %
[illegible]	_____ %	_____ %
[illegible]	_____ %	_____ %
[illegible]		
_____	_____ %	_____ %
_____	_____ %	_____ %
_____	_____ %	_____ %
	Total 100%	Total 100%

Q.6

Col. 5 List below the make/manufacturer and model for each computer and terminal, if any, which your school uses with each computer.		Col. 4 Applications for which originally obtained			Col. 3 Present Application			Col. 6 Arrangement for use by school or school system				Col. 7 This computer system is provided by				
Computer	Terminal	Administrative	Instructional	Both	Administrative	Instructional	Both	Owned	Leased	Purchased Time	Borrowed Time	School or School System	Commercial Firm	Regional Computer Collaborative	College/ University	Other (specify)

[illegible]

SECTION B

B-1 INSTRUCTIONAL APPLICATIONS

Input
Code Number

1) _____ Purpose _____

_____ Activity _____

2) _____ Purpose _____

_____ Activity _____

3) _____ Purpose _____

_____ Activity _____

4) _____ Purpose _____

_____ Activity _____

B-2 Input Code number	1)	2)	3)	4)
B-3 subject area				
B-4 student participants				
B-5 teacher participants				
B-6 student hours/mo.				
B-7 hours of actual student use/mo.				
B-8 teacher hours/mo.				
B-9 hours of actual teacher use/mo.				
B-10 total hours available/mo.				
B-11 actual running hours/mo.				
B-12 percent CPU time	%	%	%	%
B-13 grade considered				
B-14 software purpose				
B-15 programming language(s)				
B-16 source	a.			
amount	b.			
source	a.			
amount	b.			
source	a.			
amount	b.			

[illegible]

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POSTAGE WILL BE PAID BY:

Dr. George W. Johnson
Project CASS
American Institutes for Research
8555 - 16th Street
Silver Spring, Maryland 20910

[redacted]

[redacted]

[redacted]

[redacted]

Dr. Arthur L. Kaveliin
Project CASE
American Institutes for Research
8302 - 16th Street
Silver Spring, Maryland 20910

Recently, under the sponsorship of the National Science Foundation, we sent every secondary school principal in the country a questionnaire concerning computer applications in his school. If you have already returned that questionnaire, do not respond again. Thank you. If you have not returned the questionnaire, please answer the five questions below. Then, simply drop this postal card in a mail box. Thank you.

1. Does your school use a computer for instructional purposes?
   Yes ☐ No ☒
2. If yes, is the computer used at least:
   Once a week? ☐ Once a month? ☐
   Once during the school year? ☐
3. Does your school offer a formal course in which a computer is used?
   Yes ☐ No ☒
4. Does your school use a computer for administrative purposes?
   Yes ☒ No ☐

[redacted]

Questions for Interview

1. YOU LISTED THESE APPLICATIONS. (List them.)
   IS THERE A SEPARATE COURSE FOR EACH OR IS THERE MORE THAN ONE APPLICATION IN A COURSE?
   COULD YOU DESCRIBE HOW THESE FIT INTO YOUR COURSES?

   (Purpose: To determine structure of the use of the computer in the school.)

2. ARE YOU RESPONSIBLE FOR ALL OF THESE APPLICATIONS?

   (Purpose: If no, you will want to make arrangements to talk to those responsible for the other applications.)

3. CAN YOU GIVE US A BRIEF HISTORY OF THE USE OF THE COMPUTER IN YOUR SCHOOL?

   (Prompt: How did the school get started in using computers?)
   (Note: Ask for dates. May get history of one application only--if so, attempt to determine history of other uses which have stopped.)

4. WHAT CAUSED YOU TO DECIDE TO USE COMPUTERS FOR INSTRUCTION?

   (Prompt: Did a colleague interest you, did the school board buy a computer for the school, did the school receive a grant,...?)
   (Purpose: Self-explanatory, plus interested in whether they sought the application or someone convinced them. What was the impetus?)

5. IN ADDITION TO THE BRIEF DESCRIPTION WHICH YOU PROVIDED IN THE QUESTIONNAIRE, WHAT CAN YOU TELL US ABOUT THE OVERALL PURPOSE OF THIS APPLICATION?

   (Prompt: What are you trying to accomplish?)

6. LIKEWISE, CAN YOU TELL US WHAT THE STUDENTS AND THE TEACHERS ACTUALLY DO WHEN PARTICIPATING IN THIS APPLICATION?

   (Prompt: How much lecturing or formal classroom work is there versus individual work? What do you and the student do when you are working with the individually?)

7. WHAT FACTORS, WHICH MIGHT DISTINGUISH YOUR SCHOOL FROM OTHERS NOT USING COMPUTERS, ARE ASSOCIATED WITH YOUR USE OF COMPUTERS FOR INSTRUCTION?

   (Prompt: Is there something about the environment in this school?)
   (Purpose: Determine what elements are present in the school environment which are associated with computer use.)

8. WHAT CAN YOU TELL US ABOUT YOUR EXPERIENCE WITH INTEGRATING COMPUTER USE INTO THE SCHOOL CURRICULUM?

(Prompt: What problems did you have? How is done currently?)
(Purpose: How did he go about integrating the application to the curriculum and is it an integral part of the curriculum?)

9. DID YOU OR YOUR STAFF PROGRAM THE CURRICULUM SOFTWARE FOR THIS APPLICATION OR DID YOU OBTAIN IT FROM AN OUTSIDE SOURCE? WHAT IS THE SOURCE?

(Note: Curriculum software in a broad sense, meaning the curriculum materials for instruction.)

10. WHAT ASPECTS OF YOUR APPLICATION DO YOU FEEL CONTRIBUTE THE MOST TO THE LEARNING OF STUDENTS?

(Prompt: What is it about the application that promotes learning?)
(Purpose: Is there something about instruction which includes the use of computers which promotes learning?)

11. IF YOU WERE TRYING TO CONVINCE A COLLEAGUE TO USE COMPUTERS FOR INSTRUCTION, WHAT IMPROVEMENTS IN INSTRUCTION IN YOUR SCHOOL RESULTING FROM THE USE OF COMPUTERS WOULD YOU POINT OUT?

(Prompt: What general improvements in the instruction in the school can be attributed to the use of computers?)
(Purpose: What favorable impact does the computer have on instruction in the school?)

12. OF WHAT NEGATIVE RESULTS OF THE USE OF COMPUTERS MIGHT YOU WARN THIS COLLEAGUE?

(Prompt: What are the negative ramifications resulting from the use of computers?)

13. OF WHAT PROBLEMS WOULD YOU WARN HIM?

(Prompt: What problems do you have with your application?)

14. HOW SATISFIED ARE YOU WITH YOUR APPLICATION?

(Prompt: How would you rate your satisfaction?)

15. HOW PERMANENT IS THIS COMPUTER APPLICATION: THAT IS, HOW LONG A LIFE SPAN DO YOU ENVISION FOR THIS APPLICATION?

(Prompt: Will it go on indefinitely before it stops or changes so much that it is different?)
(Purpose: Is this a temporary or well-entrenched application?)

16. WHAT LEVEL OF ACHIEVEMENT BY YOUR STUDENTS ARE YOU SHOOTING FOR?

(Prompt: Is there a minimum standard they must achieve?)

17. WHAT IS THE BREAKDOWN OF TOTAL COST OF THIS COMPUTER APPLICATION FOR SUCH ITEMS AS PERSONNEL, COMPUTER TIME, MATERIALS, ETC.?

(Prompt: Can you give us a rough percentage breakdown for personnel versus hardware? Is it 60-40, 80-20?)
(Note: If they can give a complete cost breakdown, fine; if not, ask for a personnel versus hardware cost.)

18. HOW HAVE THESE COSTS VARIED AS THE COMPUTER APPLICATION WAS DEVELOPED?

(Prompt: Was personnel more or less expensive than hardware in the beginning?)

19. WOULD YOU LIST THE PERSONNEL BY TITLE THAT ARE INVOLVED WITH THIS APPLICATION PART-TIME AND THOSE INVOLVED FULL-TIME?

20. WHAT FEATURES WOULD YOU LIKE TO INCLUDE IN THE SYSTEM WHICH YOU CANNOT BECAUSE OF COST RESTRICTIONS?

(Prompt: What is your dream?)

21. WHAT ARE YOUR PLANS FOR EXPANDING YOUR PRESENT INSTRUCTIONAL APPLICATION(S) OR ADDING NEW ONES IN THE FUTURE?

22. WHEN WILL THIS EXPANSION OR ADDITION BE IMPLEMENTED?

(Purpose: They may discuss plans, but how firm are these plans? Can they give a date for implementation?)

23. WHAT DO YOU NEED TO CONTINUE OR TO EXPAND YOUR APPLICATIONS?

(Prompt: What is *your* greatest need now? Is it money, training, advice, etc.?)

24. WHAT IS THE BEST WAY THAT OUTSIDE SOURCES COULD HELP YOU IN YOUR USE OF COMPUTERS?

(Note: Outside sources include government, industry, private foundations, any community source.)

25. ARE THE TEACHERS ON THE STAFF ADEQUATELY TRAINED IN THE INSTRUCTIONAL USES OF COMPUTERS OR IS THIS ONE OF YOUR PROBLEMS?

26. IF THE TEACHERS ARE NOT ADEQUATELY TRAINED, WHAT TYPE OF TRAINING DO THEY NEED TO ADEQUATELY HANDLE THE APPLICATIONS AND/OR EXPAND THE APPLICATIONS?

27. HERE IS A LIST OF SCHOOLS IN THE _____ AREA WHICH REPORTED INSTRUCTIONAL COMPUTER USES TO US. DO YOU KNOW OF ANY OTHER SCHOOLS IN THE AREA WHICH ARE USING COMPUTERS INSTRUCTIONALLY?

(Purpose: Get any we missed.)

29. WHAT COOPERATIVE ARRANGEMENTS ARE YOU INVOLVED WITH FOR DEVELOPING OR USING COMPUTERS AT THE SECONDARY LEVEL?

29. ARE YOU INVOLVED IN ANY EFFORTS TO SHARE INFORMATION ABOUT COMPUTER USE?

30. HOW USEFUL WOULD YOU FIND INFORMATION CONCERNING INSTRUCTIONAL USES OF COMPUTERS IN OTHER SCHOOLS?

31. WHAT KINDS OF INFORMATION WOULD YOU MOST LIKE TO SHARE?

(Prompt: Specifics about applications, curriculum materials, general information about purpose?)

32. DO YOU HAVE ANY CURRICULUM MATERIALS OR OTHER INFORMATION ABOUT YOUR APPLICATIONS WHICH YOU CAN SHARE WITH US?

APPENDIX J

Definitions

J-0. Schools visited

J-0. Schools called

29. Schools visited

Glendale Central High School
Glendale, Illinois

New Trier Township High School
Winnetka, Illinois

York Comm. High School
Elmhurst, Illinois

Clearbrook South High School
Clearview, Illinois

Calvin Park High School
Chicago, Illinois

Bucks County Technical School
Fairless Hills, Pennsylvania

Haverford School District
Senior High School
Havertown, Pennsylvania

Wilson High School
Portland, Oregon

Lincoln High School
Portland, Oregon

West Linn High School
West Linn, Oregon

Lake Oswego High School
Lake Oswego, Oregon

Centennial High
Gresham, Oregon

Littleton High School
Littleton, New Hampshire

Carver Vocational High School
Atlanta, Georgia

Galileo High School
San Francisco, California

Half Moon Bay High School
Half Moon Bay, California

San Carlos High
San Carlos, California

San Lorenzo High
San Lorenzo, California

Kingston High School
Denver, Colorado

Broomfield Senior High School
Broomfield, Colorado

South High School
Denver, Colorado

Abraham Lincoln High School
Brooklyn, New York

Stuyvesant High
New York, N. Y.

Frederick Douglas Intermediate School
New York, N. Y.

Jamaica High School
Jamaica, New York

Intermediate School 96
Brooklyn, New York

Syosset High School
Syosset, New York

Half Hollow Hills High School
Dix Hills, New York

Keene High
Keene, New Hampshire

Hendersonville High School
Hendersonville, North Carolina

Harding High School
Charlotte, North Carolina

Schools Visited

Seacrest High School
Delray Beach, Florida

Miami Edison Senior High School
Miami, Florida

Antioch High
Antioch, Tennessee

Warren County Senior High
McMinnville, Tennessee

Worthington High School
Worthington, Ohio

Lemans Local
Lima, Ohio

Edison Jr. Sr. High School
Tulsa, Oklahoma

Adair High School
Adair, Oklahoma

Gatesville State School for Boys
Gatesville, Texas

Killeen High School
Killeen, Texas

Green River Senior High School
Green River, Wyoming

Natrona County High School
Casper, Wyoming

Catalina High School
Tucson, Arizona

Salpointe High School
Salpointe, Arizona

Woodrow Wilson High School
San Francisco, Calif.

Irvington High School
Fremont, Cal. 94538

Shaw Jr. High School
Philadelphia, Pa.

William Penn High School
Philadelphia, Pa.

29. Schools called

Central School
Windsor, New York

Franklin High School
Franklin, Wisconsin

Lassen High School
Susanville, California

Fort Vancouver High School
Vancouver, Washington

Santa Ynez High School
Santa Ynez, California

Trenton Central High School
Trenton, New Jersey

Greater Johnstown Central Senior High
Johnstown, Pennsylvania

Lyman Hall High School
Wallingford, Connecticut

Hartford Union High School
Hartford, Wisconsin

Memorial High School
Beloit, Wisconsin

Cook County High School
Grand Marais, Minnesota

Thomas Jefferson High School
Richmond, Virginia

Logan Junior High School
Altoona, Pennsylvania

Windber Area High School
Windber, Pennsylvania

Ft. Defiance High School
Ft. Defiance, Virginia

Staples High School
Westport, Connecticut

Los Alamos High School
Los Alamos, New Mexico

Moscow High School
Moscow, Idaho

Chipley High School
Chipley, Florida

Ashland Senior High School
Ashland, Oregon

Lawrence High School
Lawrence, Kansas

Lincoln High School
Stockton, California

Norwich Senior High School
Norwich, New York

Great Falls High School
Great Falls, Montana

Pleasant Grove High School
Pleasant Grove, Utah

Eureka County High School
Eureka, Nevada

Dedham High School
Dedham, Massachusetts

Milton High School
Milton, Massachusetts

Billerica Memorial High School
Billerica, Massachusetts

Gere. Law. Tech. Inst.
Andover, Massachusetts

Norwood Senior High School
Norwood, Massachusetts

Richfield High School
Richfield, Minnesota

Osseo Senior High
Osseo, Minnesota

Southwest High School
Minneapolis, Minnesota

Valley View Junior High
Edina, Minnesota

[illegible]

[illegible] High School
Costa Mesa, California

[illegible] High School
[illegible], California

[illegible] High School
[illegible], California

[illegible] High School
Huntington Beach, California

Ulair High School
Pasadena, California

APPENDIX B

Sources of Data for Basic Questions

Basic Question	Questionnaire	Postal Card	Interview
Extent Administrative & Instructional			
1	A-17, B-10	4	-
2	A-17, B-1 thru B-9	1	-
Degree of Administrative & Instructional			
3	C-2 (Column 3 & 5)	-	-
4	C-2 (Column 4)	-	
5	C-2 (Column 3 & 5)	-	-
6	C-2 (Column 4)	-	-
7	B-1 thru B-9	-	-
8	B-4 thru B-9	-	-
9	B-10, B-11	2	-
Nature and Purpose of Instructional Applications			
10	B-1 thru B-9	-	-
11	B-1 thru B-9	-	-
12	B-1	-	6
13	B-1	-	5
14	B-2	-	1
15	B-3	2, 3	1, 6
16	B-13	-	-
17	B-4 thru B-9	-	1
18	B-1, B-7, B-9	-	6
19	-	-	24
20	-	-	10, 11
21	B-16	-	9
22	B-15	-	-
23	B-12	-	1, 6

Basic Question	Questionnaire	Postal Card	Interview
Level & Sources of Support of Instructional Use			
24	C-1	-	17, 18
25	C-1	-	-
26	D-16	-	-
27	-	-	28, 29
28	A-11, A-12, D-3	2, 3	1, 8
29	A-11	-	-
School Characteristics & Use			
30	A-6 thru A-9	-	-
Previous Use			
31	-	-	5, 6
32	A-13	-	9
33	A-13	-	5, 6
Plans for Future Use			
34	-	-	19
35	A-14, A-15	-	20, 21
36	A-16	-	22
37	-	-	12, 13, 14
38	-	-	23, 24, 25, 26,

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[illegible]